

Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents and young adults - 16.06.2021 - Julia Dratva, Frank Wieber, Simona Marti, Anthony Klein Swormink.

## Literature screening report

# Secondary health impact of COVID-19 containment measures in children, adolescents and young adults

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## Abstract

Given the rather small number of studies that we have identified so far in our literature search, we refer to the summaries of the respective questions for a comprehensive overview of the current findings.

However, with the to be expected growth in the number of studies that are covered, we will complement the summaries of the questions with a concise abstract.

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## Preamble

*A large number of scientific publications become available on a daily basis, reflecting the rapid development of knowledge and progress of science on COVID-19 related issues. Leading authorities should base decisions or policies on this knowledge; hence they need to master the actual state of this knowledge. Due to the large number of publications shared daily, decision makers heavily depend on accurate summaries of these publications, in the different public health domains. Therefore, the authors of this report were mandated by the Swiss School of Public Health plus (SSPH+), on request of the Federal Office of Public Health (FOPH), to inform the FOPH on recent findings from the literature.*

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## Background

The COVID-19 pandemic is an unprecedented global public health crisis touching the whole population in different ways. Since the beginning of the pandemic containment measures and policies have been implemented to curb the epidemics. Driven by the scenario of an exponential epidemic and overburdened health system, the Swiss government ordered different containment policies and hygiene recommendations. Current but still limited evidence indicates that children and adolescents have an equally high attack rate, but luckily are at far less risk to contract severe COVID-19. However, more and more research indicates that containment measures impact health in the young population, leading to secondary health risks and adverse outcomes in children, adolescents, and young adults. The literature screening report extracts evidence on these secondary health impacts both from peer-reviewed publications addressing the situation in Europe and Swiss grey literature and presents this evidence in a narrative resumé.

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## Questions addressed.

- What impact do the pandemic and the containment measures have on everyday activities of children, adolescents, and young adults?
  - What impact do the pandemic and the containment measures have on physical health of children, adolescents, and young adults?
  - What impact do the pandemic and the containment measures have on mental health of children, adolescents, and young adults?
  - What impact does the pandemic and the containment measure “school closures” have on children, adolescents, and young adults?
  - What impact do the pandemic and the containment measures have on vulnerable children, adolescents, and young adults?
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## Methodology

The literature search spans the period January 1<sup>st</sup>, 2020 until the end of the project. Three literature data banks are accessed to identify relevant literature: PubMed (biomedical literature), Embase (biomedical), and PsycInfo (psychological literature). A search string was defined and tested based on the study questions and outcomes of interest (see attachment). The search string was adapted to the three literature data banks, which provide different features for selective searching. For the scientific literature prior to the start of the project, we could resort to existing results of a systematic literature search by the EUPHA section Child and Adolescent Public Health directorate (CAPH) with the same outcomes and exposure in the age-group 0 to 18 years for the time from January 1<sup>st</sup>, 2020 – mid-February 2021. The full search in age 0 to 25-year-olds using the project search string starts mid-February 2021 and publications are searched retrospectively.

With the start of the project a PubMed and PsycInfo search is conducted weekly, literature is exported into Rayyan ([www.rayyan.qcri.org/](http://www.rayyan.qcri.org/)), an open systematic literature search software, and screened for inclusion. Screening is performed by one researcher; in case of questions a second opinion is requested. Inclusion criteria are data on children, age 0 – 25 years, exposure related to pandemic policies or containment measures, outcomes according to study questions, and study data from European continent. Publications without any data collected during the pandemic or publications without primary study data and peer-review such as guideline papers, letters or opinion pieces are excluded. Web of Science is searched monthly. Included publications are categorized and rated and relevant results extracted in a programmed Excel sheet by a researcher. Quality rating (yes, no, partly) is based on three questions: 1. “Was the study sample clearly described?” 2. “Were confounding factors identified or discussed?”, and 3. “Were outcomes measured in a valid and reliable way?”. All studies included in the narrative review are considered of sufficient quality. If quality issues should limit the interpretation of the results, such issues will be reported alongside the publication.

Lastly, a search for grey literature, restricted to Switzerland, will be performed via a desktop search at two time points during mandate. National stakeholders: Pro Juventute, SclarMed, UNICEF-CH, Caritas, HEKS, SRK, GS SODK, KOKES, and EKKJ will be approached for grey literature of interest they may have produced or know of. Data will be extracted from the management summaries and included in the overall narrative review.

## Results and Findings

### What impact do the pandemic and the containment measures have on everyday activities of children, adolescents, and young adults?

#### Summary

Overall, there is still limited evidence on physical activity and nutritional behavior. The presented studies point to a decrease in physical activity during confinement at home. It also underlines the relevance of cultural or environmental differences, with higher impact on lifestyle in Latin American countries as compared to European countries. For food consumption changes are documented but they vary in direction and health relevance. The increase in sweet foods seems inconsistent. [Some studies can refer to previous data and using established nutritional questionnaires, they indicate an overall worsening of health.](#)

An increasing body of evidence points to changes in sleep in children, adolescents, and young adults, mostly in the direction of longer sleep duration and change of bedtime and wake-up times. Initial evidence points to negative impact on mental health of lower sleep duration during the pandemic. Screen time is investigated both as sedentary lifestyle and as a pass-time (social media, tv). In both cases, confinement seems to increase screen time both in healthy youth and in children with ADHD.

**Number of publications:** 17

**Time period:** Jan 2020 – Sept 2021, single publications from [March - May 2021](#).

#### Results

##### Physical activity and screen time

A high prevalence of **physical inactivity** among adolescents (10 – 19 years), before and during lockdown, was reported by Ruiz-Roso et al. (2020): 79.5% during the confinement period vs. 73% before. The study compares physical activity and processed food consumption before and during the lockdown in different countries, among them Italy and Spain. Risk of low physical activity was higher in Latin America as compared to Europe (OR 2.98; 95% CI; 1.80 – 4.94) and in adolescents with mothers with higher education (OR 2.32; 95% CI; 0.99 – 5.44). Boys were more active before/during the lockdown compared to girls (OR 2.22; 95% CI; 1.28 – 3.86). The study used the

IPAQ, an international validated instrument to measure physical activity, however both the information on the before and during lockdown behaviors was retrospectively reported.

A longitudinal study from Spain (Medrano et al., 2021) examined the effects of home confinement on lifestyle behaviors in 8- to 16-year-old children ( $N = 113$ ). Results show that physical activity decreased ( $-91 \pm 55$  min/day,  $p < .001$ ) during the confinement while at the same time the screen time increased ( $1.9 \pm 2.6$  hours/day,  $p < .001$ ) compared to the pre-pandemic collected data. Screen time, as a measure of sedentary lifestyle, is often measured together with physical activity. In this study it was the only outcome that varied according gender: during the confinement, male participants increased their screen time more than the female participants ( $2.3 \pm 0.3$  hours/day vs.  $1.3 \pm 0.3$  hours/day,  $p < .03$ ). Overall, the results showed that children from families with social vulnerabilities (for example mothers with non-Spanish origin or a low educational level, low socioeconomic status) were more negatively affected by the Covid-19 confinement (Medrano et al. 2021). Comparing the age groups 5 to 12 and 13 to 18 years, a study by Passanisi et al. (2020) found that older individuals reported that they were more physically active than younger subjects ( $p < .001$ ).

A multi-country cross-sectional study (UK, IRE, NZ and AUS;  $N = 8425$ ,  $M = 44.5$  years,  $SD = 14.8$  years; 70.7% female and 93.8% white) investigated physical activity (IPAQ-SF) in the early phase of the COVID-19 restrictions of each country in >18-year-olds. Younger people (18-29 years) reported more negatives changes (decreasing exercise behavior 26.1%) than all other age groups (between 11.1% -19.1%,  $p = < .001$ ) (Faulkner et al., 2021).

Finally, in a Greek study that examined how young adults ( $N = 1559$ , 18 - 30 years) coped with COVID-19-related problems, 39.8% indicated that they used practicing sports either “a lot” or “very much” (Golemis et al. 2021).

A cross-sectional Italian study (Censi et al., 2021), collected data on physical activity, eating habits, and perception of behavior of 1027 Italian 2- to 11-year-old children during the end of the first lockdown, from May 18<sup>th</sup> to June 30<sup>th</sup>, 2020. 78.1% of the children stopped their habitual physical activity, with higher percentage among 6- to 11-year-olds and in children from northern regions.

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Only 51.8% maintained some activities at home, playing mainly movement games/sports in available spaces such as gardens, balconies, or in-doors. Parents reported that children spent a lot (54%) and some (37%) more time with digital devices.

#### Nutrition and eating behavior

Ruiz-Roso et al also investigated **nutritional behaviors**. Results can be summarized accordingly: Changes in food consumption differ by food type. General increase in legumes and fruit, and sweet foods and beverages, while no change in processed meat and decrease in fast food. Associated factors like gender, maternal education and family size vary regarding the impact on food consumption. An Italian study (Pietrobelli et al, 2020) in obese children confirms changes, however, is not fully consistent with Ruiz-Roso et al. They did not find change in legumes and fruit but change in meat consumption. In a study on diabetics, more than half of patients (56.9%) did not change their eating habits during the lock-down period, while 26.5% increased carbohydrate consumption, 7.8% and 8.8% ate a large amount of fat and protein, respectively.

Regarding dietary behaviors Medrano et al. (2021) observed an increase in the KIDMED score ("Mediterranean Diet Quality Index") of  $0.5 \pm 2.2$  points during the confinement ( $p < .02$ ) although the prevalence of children and adolescents with a high compliance to the Mediterranean diet did not significantly improve ( $p > .50$ ) (Medrano et al. 2021).

A study by Herle et al. (2021) examined the trajectories of eating behavior of 22'374 adults over 18 years of age during the lockdown in the UK. The results show that women compared to men (OR = 1.82, SE: 0.17,  $p < .001$ ) and participants aged 18 to 29 compared to participants over 60 years of age (OR = 2.27, SE: 0.42,  $p < .01$ ) were more likely to eat more at the beginning of the lockdown, but their eating behaviors returned gradually to normal as the lockdown continued (Herle et al., 2021).

A cross-sectional study in south Italy (Pisano et al., 2021) collected data from a convenient sample of 326 adolescents ( $M_{males} = 18.8$  years,  $SD = 1.3$ ;  $M_{females} = 16.0$  years,  $SD = 1.4$ , 24.2%) during the strictest quarantine period from April 25<sup>th</sup> to May 13<sup>th</sup> 2020 using a web-based online survey. 82% of adolescents stated that they had modified the quantity of their diet (54% "a little", 28.2% "a



lot") and 57.96% changed the quality (42.9% "a little", 15.0% "a lot") of their food (Pisano et al., 2021).

The data by Censi et al. showed a tendency of less healthy eating behavior, measured by a validated instrument KIDMED, by age and a North-South gradient. The later finding is consistent with previous studies. The comparison of the lockdown data with previous KIDMED studies is limited due to change in methodology but indicate that there was an increase in some key foods of the Mediterranean Diet, however, the overall eating score was poorer. 32.3% of the children had high adherence to Mediterranean Diet, with better scores in children aged 2–5 years (Censi et al., 2021).

#### Sleep (and screen time)

A health relevant daily behavior is sleep. Studies indicate an increase in sleep time in children and youth. Pietrobelli et al. (2020) report increased sleep time ( $M = 0.65$  hours/day,  $SD = 1.29$ , hours/day,  $p = .003$ ). They also found that children's screen time increased ( $M = 4.85$  hours/day;  $SD = 2.40$  hours/day;  $p < .001$ ), which has often been associated with insufficient sleep or sleep problems. A longitudinal study from Spain (Medrano et al. 2021) also examined the effects of home confinement on sleep. The sleeping time increased both on weekdays ( $0.8 \pm 1.1$  hours/day,  $p < .001$ ) and on weekend days ( $0.7 \pm 1.6$  hours/day,  $p < .001$ ).

More specifically, Kaditis et al. (2021) collected data on children's sleep habits from different countries in a cross-sectional online survey. 845 parents participated from first of May to 10th of June 2020 (15.5% were from Europe). Compared to before the pandemic, bedtime was significantly later on weekdays and weekends ( $p < .01$ ) and children woke up later during COVID-19 than before ( $p < .01$ ). The median sleep duration score on weekdays increased significantly ( $p < .001$ ), while there was no significant change during the weekend ( $p = .51$ ). Impact on sleep differed by age group: 14- to 17-year-olds showed an increase in sleep duration on weekdays, 3- to 5-year-old children a decrease in sleep duration on weekdays and weekends. There was a significant increase in screen time in all age groups ( $p < .001$ ). Increase in sleep duration on weekdays was borderline significant ( $p < 0.057$ ,  $N = 106$ ) in the European sub-sample (Kaditis et al., 2021).



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Evans et al. collected self-reported data from 254 undergraduates (219 females) at a UK university at two-time points: autumn 2019 (baseline, pre-pandemic) and April/May 2020 (under 'lockdown' conditions). Longitudinal analyses showed no significant changes in anxiety, loneliness, or sleep quality, but a significant rise in depression symptoms ( $p = <.001$ ) and a reduction in wellbeing ( $p = <.001$ ) at lockdown. The increase in depression symptoms was highly correlated with worsened sleep quality ( $p = <.001$ ). A shift towards an 'evening' diurnal preference ( $p = <.012$ ) was observed. (Evans et al., 2021).

Further, in a study in four longitudinal age-homogeneous British cohorts during the first UK national lockdown (May 2020), 21.9% of the Millennium Cohort Study participants (MCS, 19 to 20 years) reported getting less sleep. Key workers<sup>1</sup> were at higher odds of sleeping less than other participants (OR 1.64, 95% CI; 1.11 – 2.38,  $p = .011$ ) (Topriceanu et al., 2021). The cross-sectional study in south Italy (Pisano et al., 2021, see above) that collected data from a convenient sample of 326 adolescents during the strictest quarantine period from April 25<sup>th</sup> to May 13<sup>th</sup> 2020 using a web-based online survey observed that 40.5% reported that the quality of their sleep has been modified "very much", 37.7% "a little", and 21.8% "not at all".

Luijten et al. (2021) conducted a study in 8- to 18-year-old children and adolescents during the COVID-19 pandemic in the Netherlands (April 2020,  $N = 844$ ) and compared the data with a representative sample of Dutch children/adolescents before COVID-19 (2018,  $N = 2401$ ). Both studies applied the Patient-Reported Outcomes Measurement Information System (PROMIS) domains: global health, peer relationships, anxiety, depressive symptoms, anger, sleep-related impairment. Severe Sleep-Related Impairment was more frequent during versus before the pandemic (11.5% vs. 6.1%; RR = 1.89; 95% CI; 1.29 – 2.78).

#### Internet/Social media (and screen time)

The Greek study by Golemis et al. (2021) also investigated social media activity in 18- to 30-year-olds ( $N = 1559$ ). Significantly more women created a new social media account and used the social media longer than 5 h/day, compared with men.

<sup>1</sup> Key worker status was self-assigned based on whether the participant believed their work has been classified as critical to the COVID-19 response

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A cross-sectional study in Switzerland examined the use of screen-media in ADHD patients from end of May 2020 until the first week of July 2020 ( $N = 126$ , 10 to 18 years) and documents an increase of media consumption during the lockdown. The smartphone use of more than 4 h per day increased from 15% before the COVID-19 crisis to 36% under lockdown, use of tablet/PC use from 2% to 22% and gaming console from 3% to 11%. Excessive TV use under lockdown (over 6 h) was not reported. The estimated total media time (eTMT) over time increased significantly during the lockdown (6.76 h), and decreased significantly with increasing loosening of the measures (4.42 h), but eTMT did not completely return to pre-Corona levels (3.89 h,  $p < .001$ ). Adolescents had considerably higher eTMT compared to children (mean eTMT: adolescents 8.39 h, children 5.29 h,  $p < .001$ ) and 10- to 13-year-old children showed less gaming and social media time than 14- to 18-year-old children (Werling et al., 2021).

## What impact do the pandemic and the containment measures have on physical health of children, adolescents, and young adults?

### Summary

A number of studies focus on children and adolescents with specific diseases and/or health needs during the pandemic. Depending on the health endpoint, containment measures have different impact. While limited evidence exists so far on the impact on body weight, a simulation model and some first data indicate that school closure and reduced mobility is associated with an BMI increase in both normal weight and obese children. Hygiene measures, for example, are shown to increase the prevalence of hand eczema in children, irrespective of previous atopic dermatitis. Research on diabetic type 1 in children and adolescents indicates no adverse impact on diabetes management [and control](#). Lock-down is even associated with a better metabolic performance in patient populations with different treatment regimens and technologies. However, the patient samples are small. Improvement was also seen in two studies regarding infection related throat, nose, and throat medicine: otitis media episodes and adenoid or tonsillar hypertrophy symptoms. Also, in recurrent preschool wheezers, a reduction of symptoms, medication and health services needs was reported during the lockdown. [A study on asthma control indicates good control throughout the lockdown](#). Lastly, a study on intestinal bowel disease reports the lockdown to impact on state-of-the-art diagnostic procedures and consequently treatment.

A change in health care utilization is reported [consistently](#) by studies early in the pandemic, mostly investigating the lockdown in spring. They show a large decrease in emergency department (ED) visits, [however, the reduction rates in ED visits vary a lot across the studies](#). Evidence of patients presenting themselves with higher severity scores [is increasing and authors imply parents' hesitancy to present their child](#). Regarding different diagnoses, most studies agree in a reduction of trauma and injuries, as well as a change in demographic characteristics of trauma/injured patients and associated causes. [Evidence is however increasing on more household trauma, such as ingestions, falls and refer to physical abuse](#). [Some diagnoses seem to have gone "missing", mostly infectious disease related diagnoses](#). Initial evidence is presented on an increase in mental health diagnoses in ED.

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In the screened literature so far, we did not find relevant publications on the following topic:  
Sexual abuse.

**Number of publications: 48**

**Time period:** Jan 2020 – Sept 2021, publications from [March - May 2021](#).

## Results

### Impact on body weight

Early in 2020, a simulation study using child cohort data (USA, pre- and primary school age cohort) investigated the impact of 4 scenarios regarding different length of school closures and 10% reduced physical activity during summer months. The scenarios show an increasing a significant rise in BMI prevalence and BMI-z-score over time compared to the control group. Depending on the scenario the BMI z-score increase by 0.056, 0.084, 0.141, and 0.198 and BMI prevalence by 0.640, 0.972, 1.676, and 2.373 percentage points (An, 2020). We included this study, albeit originating from the United States, because it exemplifies the use of existing data to estimate impact of measures prior to their implementation. In the meantime, first BMI data from Europe collected during the pandemic has been published. Pietrobelli et al. (2020) confirm that obese children changed their life style unfavorably 3 weeks into their confinement during the national lockdown compared to pre-pandemic data: significant increase in sweet foods, red meat and fast foods, decrease in physical activity ( $M = -2.30$  hours/week;  $SD = 4.60$  hours/week;  $p = .003$ ) and increase in screen time ( $M = 4.85$  hours/day;  $SD = 2.40$  hours/day;  $p < .001$ ).

### Impact on chronic diseases/Impact on acute diseases

A number of studies focus on children and adolescents' health care utilization, children with specific chronic diseases and/or health needs. They address both preventive care, disease management and symptoms. Another frequent topic is emergency utilization.

### Vaccination:

Mc Donald at al. (2020) studied the impact of coronavirus disease (COVID-19) on routine childhood vaccination in England. Measles-mumps-rubella vaccination (12 to 18-month-olds) counts dropped prior to physical distancing measure, but showed highest drop 3 weeks after physical distancing by

19.8% (95% CI; -20.7 – -18.9) and hexavalent vaccination (<6-month-olds) was 6.7% (95% CI; -7.1 – -6.2) compared to same period in 2019. Albeit containment measure continued, in week 16 and 17 counts were higher than 2019, indicating a rebound and improvement in mid-April.

### Specific diseases

Significant ( $p < .001$ ) reduction of **acute otitis media** episodes/month compared to pre-pandemic time period ( $M = 0.07$ ,  $SD = 0.35$  vs.  $M = 0.37$ ,  $SD = 0.64$ , respectively), otorrhea episodes/month ( $M = 0.01$ ,  $SD = 0.09$  vs.  $M = 0.48$ ,  $SD = 0.80$ , respectively) and the use of antibiotics ( $M = 0.09$ ,  $SD = 0.38$  vs.  $M = 0.85$ ,  $SD = 0.88$ , respectively) was observed in a study in Italy by Toretta et al. (2020). Parents in this Italian study also reported improvement in 82.3% of the cases. Another study from Italy (Gelardi et al., 2020) yields reduced exposure to children due to closed day care and schools led to a clinical improvement in otalgia, otorrhea and hearing loss in children with **adenoid or tonsillar hypertrophy**, as rated by the parents ( $N = 120$ ), leading to changes in therapy. Moreover, parents attributed a lower average symptom score of 4.1 as compared to a score of 6.7 on a 0-10-point Likert scale ( $p < .0001$ ).

In two Danish studies, hygiene measures are reported to cause **hand eczema** (dry, red and itchy skin) in children without any prior symptoms (Borch et al., 2020; 42.4%) and to increase eczema in children with previous atopic dermatitis (Simonsen et al., 2021; increase by 31.5 percentage points ( $p < .001$ )). Borch et al. report schoolchildren had a 1.5 times greater relative risk of developing irritant contact dermatitis (ICD) than preschool children. The study by Simonsen et al. was in daycare children. Frequency of hand washing was a strong risk factor, whereas this was not the case for alcohol-based hand sanitizer. Hand washing 7-10 times/day and >10 times/day increased the relative risk by 1.83 and 2.23 times, respectively (Borch et al., 2020). Simonsen et al. additionally found atopic dermatitis, female gender, and higher age, to be associated with eczema.

A number of studies exist on **diabetes** and diabetes management. In a study from Italy, Passanisi et al. (2020) found some benefits of lock-down measures regarding diabetes type 1 (T1D) management in 204 patients recently diagnosed with T1D: roughly a third of the patients reported more intensive daily glucose monitoring (33.8%) while 18.6% paid less attention to their glycemic levels, and 47.5% of patients did not report differences from the pre-quarantine period. Almost half

of the patients (49%) did not need to contact the Diabetes team for advice on managing their disease. Children <12 years were significantly more influenced by the quarantine period in their approach to the disease than older patients ( $p = .017$ ). Christoforidis et al. (2020) from Greece confirmed that glycemic control can be adequately achieved comparable to the pre-lockdown period in children with type 1 diabetes mellitus wearing an insulin pump equipped with a sensor ( $N = 34$ ). They showed similar mean time in range (TIR) values.

In another study from Italy (Schiaffini et al., 2020), data from 22 school children that were equipped with a Tandem Basal IQ Technology providing real-time glycemic control data, indicated significantly ( $p < .001$ ) higher median value of TIR (66.41% vs. pre-pandemic 61.45%) and a showed a lower time above range value (TAR) during in-pandemic period than pre-pandemic ( $29.86 \pm 10.6\%$  vs  $34.73 \pm 12.8\%$ ,  $p < .002$ ). Tornese et al. (2020), in a study in Italy, support the findings on improved metabolic control of T1D in 13 adolescents using a hybrid closed loop HCL system.

This is confirmed by a study from Italy (Marigliano & Maffei, 2021) compared several glucose metrics from 233 patients with Type 1 Diabetes between the age of 2 and 18 years treated with multiple daily insulin injections or continuous subcutaneous insulin infusion (insulin pump). The data was measured at two points in time: before the lockdown (T0 = January–February 2020) and after the lockdown (T1 = May–June 2020). A significant improvement comparing pre-lockdown with post-lockdown measures was found both for males and females for glucose metrics: lower HbA1c ( $7.82 \pm 0.84$  vs.  $7.44 \pm 0.83$ ,  $p < .001$ ), GMI ( $7.60 \pm 0.75$  vs.  $7.37 \pm 0.70$ ,  $p < .001$ ), %TAR ( $43.4 \pm 16.2$  vs.  $38.0 \pm 15.8$ ,  $p < .001$ ), mean glucose (mg/dl) ( $178.6 \pm 31.2$  vs.  $169.1 \pm 28.6$ ,  $p < .001$ ), and a higher %TIR ( $52.6 \pm 15.2$  vs.  $58.0 \pm 15.1$ ,  $p < .001$ ). The analysis shows a statistically significant difference ( $p < .05$ ) between T0 and T1 with regard to BMI ( $20.9 \pm 3.7$  kg/m<sup>2</sup> vs.  $21.5 \pm 4.6$  kg/m<sup>2</sup>) and basal insulin dose ( $21.1 \pm 9.3$  IU/day vs.  $22.3 \pm 10.2$  IU/day) in female but not in male patients.

Most studies observed no differences between in-pandemic and pre-pandemic periods regarding the total insulin dose and the basal insulin delivery (Tornese et al., 2020; Schiaffini et al., 2020; Christoforidis et al., 2020) while some found statistically significant difference ( $p < .05$ ) in mean bolus doses and daily number of correction boluses (Schiaffini et al., 2020, Marigliano & Maffei, 2021) and changes in meal schedules (Christoforidis et al., 2020).

With respect to newly diagnosed diabetes in children and adolescents, Rabbone et al. (2020) invited all Italian pediatric diabetic centers to participate in a survey study (79.9% participation). They observed 23% fewer new diabetes cases compared with the same period in 2019, and children presenting with diabetic ketoacidosis (DKA) had more severe DKA ( $\text{pH} < 7.1$ ) in 2020 than in 2019 (44.3% vs. 36%, respectively;  $p = .03$ ); while DKA episodes and severe hypoglycemia were similar between the two periods. These data suggest a lower exposure to triggering factors, such as infections, but at the same time delayed diagnosis.

An Italian study on **recurrent preschool wheezers** ( $n = 85$ ),  $M = 4.2$  years ( $SD = 1.1$ ) compared data from before the pandemic data with pandemic data (Nov. 2019 to Oct. 2020) and observed a significant clinical improvement during the lockdown. Families reported a dramatic drop in wheezing episodes (V1: yes = 51; V2: yes = 0,  $p < .001$ ). There were also significant reductions in the day and nighttime symptoms, including episodes of shortness of breath ( $p < .0001$ ). The use medication dropped significantly ( $p < .001$ ). Finally, patients had significantly fewer extra medical examinations, as well as fewer emergency room visits ( $p < .0001$ ). Outcomes worsened significantly again after lockdown (Ullmann et al., 2021).

An Italian study (Di Riso et al., 2021) investigated asthma control and children's and mothers' psychological functioning in 45 **asthmatic children** aged 7 to 14 years ( $M_{Age} = 10.67$ ;  $SD_{Age} = 2.29$ ), compared to a healthy control sample matched for age and gender ( $N = 41$ ;  $Mean_{Age} = 11.02$ ;  $SD_{Age} = 2.25$ ). An online survey was conducted after the lockdown from May 28<sup>th</sup>, 2020 to August 23<sup>rd</sup>, 2020. 80% of the children had well-controlled asthma. The analysis shows that asthmatic children presented a higher level of fear to be infected compared to their healthy peers ( $p = .000$ ) with a medium effect size value.

#### Utilization of health services (hospitalizations or primary care & preventive care)

Many countries experienced a change in utilization of health services, partly due to recommendations to postpone health care appointments, reorganizations of wards and departments to cope with COVID-19 patients with impact on pediatric care (Agostini et al., 2020) or closing of specific services altogether. Overall, most studies yield evidence that contacts for most medical



conditions were lower than in comparative time periods (Mansfield et al., 2021). Some studies suggest that patients avoided health services out of fear of infection and stay-at-home rules.

A study in the UK examined primary care contacts for almost all conditions using de-identified electronic health records from the Clinical Research Practice Datalink (CPRD) Aurum (2017  $N_{11-20} = 1'233'387, N_{21-30} = 1'455'550$ ; 2018  $N_{11-20} = 1'283'296, N_{21-30} = 1'499'066$ ; 2019;  $N_{11-20} = 1'319'983, N_{21-30} = 1'517'439$ ; 2020  $N_{11-20} = 1'325'412, N_{21-30} = 1'505'172$ ). Between 2017 and 2020, they calculated weekly primary care contacts for selected acute physical conditions: asthma exacerbation, chronic obstructive pulmonary disease exacerbation, acute cardiovascular events (cerebrovascular accident, heart failure, myocardial infarction, transient ischaemic attacks, unstable angina, and venous thromboembolism), and diabetic emergency. Primary care contacts included remote and face-to-face consultations, diagnoses from hospital discharge letters, and secondary care referrals, and conditions were identified through primary care records for diagnoses, symptoms, and prescribing. Their overall study population included individuals aged 11 years or older who had at least 1 year of registration with practices contributing to CPRD Aurum in the specified period, but denominator populations varied depending on the condition being analyzed. An interrupted time-series analysis was used to formally quantify changes in conditions after the introduction of population-wide restrictions (defined as March 29<sup>th</sup>, 2020) compared with the period before their introduction (defined as Jan 1, 2017 to March 7, 2020), with data excluded for an adjustment-to-restrictions period (March 8<sup>th</sup> to 28<sup>th</sup>). [...] Primary care contacts for almost all conditions dropped considerably after the introduction of population wide restrictions. The largest reductions were observed for contacts for diabetic emergencies (OR 0.35 [95% CI; 0.25–0.50]). In the interrupted time-series analysis, with the exception of acute alcohol-related events (OR 0.98 [95% CI; 0.89–1.10]), there was evidence of a reduction in contacts for all conditions (stroke OR 0.59 [95% CI; 0.56–0.62], transient ischaemic attack OR 0.63 [95% CI; 0.58–0.67], heart failure OR 0.62 [95% CI; 0.60–0.64], myocardial infarction OR 0.72 [95% CI; 0.68–0.77], unstable angina OR 0.72 [95% CI; 0.60–0.87], venous thromboembolism OR 0.94 [95% CI; 0.90–0.99], and asthma exacerbation OR 0.88 [95% CI; 0.86–0.90]). By July 2020, except for unstable angina and acute alcohol-related events, contacts for all conditions had not recovered to pre-lockdown levels (Mansfield et al., 2021).

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In a German longitudinal study, authors compared the number of weekly visits to 78 pediatric institutions between 2019 and 2020. From mid-March 2020, visits to pediatric practices steadily decreased. From April, the weekly number of visits was more than 35% lower in 2020 than in 2019 ( $p = .005$ ). During May and the first half of June, there was also lower data entry but non-significant (Vogel et al., 2021).

An increase of cases was evidenced in a retrospective analysis of referrals from a hospital's children's social care (CSC) in the UK that compared data from April 1<sup>st</sup> to June 30<sup>th</sup>, 2020 to data from the same period in 2018 and 2019. It indicated an increase of children admitted under all categories (31%). A 69% increase in the number of referrals for suspected physical abuse was noted with strategy meetings convened in 44%, referrals of children with neurosurgical trauma increased by 140% (7 and 8 to 18,  $p = .0001$ ) as did the severity neurosurgical trauma cases by 120% (from 6 and 4 to 11,  $p = .012$ ) (Masilamani et al., 2021).

Carretier et al. (2021) report on the adaptation of care provision and consultations frequency in a "Maison de adolescents" which addresses different needs of adolescents and their families including ambulatory consultations, day hospital and an in-patient unit during the first half of 2020. They report a drop compared to 2019 in overall and mental health specific consultations in Jan/Feb (ca. 5 - 15%) and an increase in Mars to June (ca. 5 - 20%).

A Finnish retrospective cohort study from Salmi et al. (2021) compared the incidence, number and characteristics of children with newly diagnosed T1D between the pandemic study period (April 1<sup>st</sup> to October 31<sup>st</sup>, 2020) and the corresponding pre-pandemic time periods (2016-2019). The study relies of pediatric intensive care unit (PICU) data and Finnish Pediatric Diabetes Registry (FPDR) data. The results show an increase in the number of children admitted to PICU due to new-onset T1D from an average of 6.25 (pre-pandemic periods) to 20 admissions during the pandemic period resulting in an increased incidence of 9.35 /100 000 PY in 2020 compared to 2.89/1 00 000 person years (PY) in 2016-2019 (incidence rate ratio (IRR) 3.24; 95% CI; 1.80 – 5.83;  $p = .0001$ ). The incidence of children registered to FPDR increased from 38.7/100 000 PY in 2016-2019 to 56.0/100 000 PY in 2020 (IRR 1.45; 95% CI; 1.13 – 1.86;  $p = .004$ ). There is no evidence for infection with

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SARS-CoV-2 to play a role, however the authors imply indirect effects of the pandemic for example delayed diagnosis.

#### Impact of masks

A study from Tornero-Aguilera & Clemente-Suárez (2021) assessed the impact of surgical mask use in cognitive and psychophysiological response of 50 university students (age  $20.2 \pm 2.9$ ; 38 male and 12 female participants) during a lesson. To do that, they analyzed two different settings: 1) personal face-to-face class with a mandatory use of a surgical mask during the entire lecture time and 2) online class with the student at home not wearing a mask, both types of lectures started at 8.30 A.M and lasted 150 minutes. For each setting, there were two measuring times: before and after the lesson. The results show that the mental fatigue perception and reaction time significantly increased after both settings (lessons with and without the use of a surgical mask). Furthermore, the authors found a significant decrease in the blood oxygen saturation after the class with mask use (no surgical mask, pre:  $98.2 \pm 0.2$ ; post:  $98.4 \pm 0.5$ ; surgical mask, pre:  $98.4 \pm 1.1$ ; post:  $96.0 \pm 1.8$ ,  $p < .001$ ) and an increase in heart rate (no surgical mask, pre:  $71.4 \pm 14.6$ ; post:  $77.7 \pm 18.2$ ; surgical mask, pre:  $78.6 \pm 9.4$ ; post:  $89.3 \pm 11.2$ ,  $p < .001$ ).

#### Impact on diagnostics/treatment

During the lockdown, patients with symptoms of Intestinal Bowel Disease (IBD) did not receive normal standard of diagnostics. In participating gastroenterological centers in the UK (90% participation), in 53.3% of the cases, the diagnosis was only presumed on the basis of the clinical symptoms, without endoscopy/histological examination, with therapeutic consequences (Ashton et al., 2020).

A Turkish study investigated the discontinuation of regular visits to the pediatric rehabilitation service in children with **cerebral palsy**. Parents/caregivers ( $N = 94$ ) reported irregular visits in 81%, in most cases due to fear of infection (54.3%). They reported discontinuation (12.8%) or pausing (53.2%, median = 3 months break (range 0 to 6.5 months)) of physical therapy and worsening of physical status (mobility 55.4%, spasticity 58.5%, joint motion 61.7%, social function 51.1% and mood 55.4%), as well as worsening of children's general health (45.7%) during the COVID-19 pandemic (Cankurtaran et al., 2021).

Another Turkish study aimed to analyze effects of COVID-19 on the compliance of children with subcutaneous allergen immunotherapy. The total sample included 201 participants, who received SCIT between 9.4 and 15.2 years (mean = 12.8 years). The longitudinal study compared data which was collected before (September 2012) and during COVID-19 (July 2020). The real-life compliance rate before COVID-19 (measured data from September 2012 to March 2020) was 86.1% (173 out of 201 patients). Overall, there were 28 dropouts. During COVID-19 (measured data starting from mid-March 2020) there was a total of 108 participants who continued to receive SCIT. The real-life compliance rate during COVID-19 was 71.3% (77 out of 108 participants). The total dropouts were 31. The most frequent reason for drop-out was fear of being infected with COVID-19 (35.4%), followed by the belief that the SCIT practice stopped due to the COVID-19 pandemic (29%). Male gender (OR: 2.972, 95% CI: 1.132–7.804,  $p = .027$ ) and higher age (OR: 1.209, 95% CI: 1.064–1.375,  $p = .004$ ) were found to be the independent risk factors for drop-out during the COVID-19 pandemic. (Aytekin et al., 2021)

A Turkish cross-sectional study (Kahraman et al., 2021) evaluated the interruption of enzyme replacement therapy (ERT) in patients with lysosomal storage diseases and the clinical subjective consequences of this interruption. 75 patients of a Children's Hospital with a median age of 12 years filled out an online survey between July 1<sup>st</sup>, 2020 to October 1<sup>st</sup>, 2020. 35 patients reported missing at least one treatment dose because of COVID-19. The median number of missed doses was four (range: 1-16 doses). The most common reason therapy interruption was fear of contracting COVID-19 at the hospital (74.3%) or not being able to acquire the medicine (17.1%). Patients who interrupted the therapy indicated physical and psychological consequences (60%).

#### Impact on emergency department hospital visits

Emergency department visit decreases were observed in many hospitals. According to a study in Italy (Comelli et al., 2020), emergency department visits in the youngest age groups declined (0 – 12, 13 – 18) while visits by adults and older age groups increased. Agostini et al. (2020) (Italy) describe a significant decrease in admissions in the pediatric emergency unit after the beginning of the lockdown phase. The percentage of decrease in emergency department varied greatly. The mean number of cases presenting daily at the pediatric emergency unit during lockdown was ~28% of those presenting during the same period of the previous year (on average 20 vs. 69 patients per

day), while Cozzi et al. (Italy) report a decrease in visits by 77.5% (Cozzi et al., 2020), [Liguoro et al. \(2021\)](#) by 73% (Italy) and Molina-Gutiérrez et al. (Spain) by 65.4% (Molina Gutiérrez et al., 2020) compares to the same period of 2019, which confirms the effect of lockdown.

Bailhache et al. (2021) who also found that during lockdown the number of pediatric emergency department visits ( $N = 3227$ ) was 60% lower than the predicted number of 7519 visits based on pre-pandemic data, and point to a large drop in infectious and respiratory disease cases (Bailhache et al. 2021). A study from Portugal (Paiva et al., 2021) comparing data from March 30<sup>th</sup> to June 30<sup>th</sup>, 2020 with the same periods in 2017, 2018, and 2019 analyzed pediatric emergency visits with respect to the referral status. There was a significant increase in the cases referred by public medical advice phone line (18.5% vs. 5.4%,  $p < .001$ ) and the Emergency Medical Services (EMS) (5.1% vs. 4.2%,  $p < .001$ ), while a reduction was seen for parents' initiative to take their child to the ES (65.5% vs. 78.6%,  $p < .001$ ), referral by primary care services (6.4% vs. 7.6%,  $p < .001$ ) and private clinics (0.4% vs. 0.6%,  $p < .001$ ).

An increased severity of cases presenting themselves is reported by more than one publication (Cozzi et al., 2020; Molina Gutiérrez et al., 2020, [Pavia et al. 2020](#)), only few report delayed care with adverse outcomes. [Liguoro et al. \(2021\)](#) found that among the fewer children visiting the pediatric emergency department (ED) the severity codes classified as "non-urgent/delayable emergencies" (white and green codes) or as "non-delayable urgencies/emergencies (yellow and red codes) changed. Green codes showed a 0.66-fold decrease (95% CI; 0.55 – 0.77), while yellow codes showed a 1.67-fold increase (95% CI; 1.36 – 2.05). No difference was shown for white and red codes. The adjusted probability of assigning an urgent code (defined as yellow or red code) was 1.46 higher (95% CI; 1.2 – 1.77) in 2020 compared to 2019. Children aged < 6 years (OR 1.23; 95% CI; 1.04 – 1.46) had a higher probability of receiving an urgent code, while no difference was shown for the older ones (OR 0.83; 95% CI; 0.53 – 1.28) nor between males and females. Furthermore, there was a relative 2.7-fold increase (95% CI; 1.9 – 3.8) in the rate of hospitalizations during the SARS-CoV-2 outbreak compared to the previous year from 3% in 2019 to 7.8% in 2020.

With respect to the change in type of diagnoses during the COVID-19 pandemic reports are inconsistent. Some publications report a decrease in respiratory infections, functional symptoms

(Cozzi et al., 2020) and injuries (Cozzi et al., 2020; Hernigou et al., 2020; Murphy et al., 2020; Park et al., 2020; Sugand et al., 2020, Liguoro et al. 2020). Others (Shepherd et al., 2021) (UK) specify that the most frequent reasons for consultation at the pediatric ED were fever (increased from 21.3% in 2019 to 26.5% in 2020,  $p = <.001$ ), respiratory symptoms (no sig. change from 16.1% in 2019 to 17% in 2020,  $p = .450$ ), and trauma (increased from 12.3% in 2019 to 15.2% in 2020,  $p = <.005$ ). Liguoro et al. also report an increase in mental health diagnoses in the ED (Liguoro et al. 2020)

A retrospective observational cohort study of all children (0 to 15 years) attending for urgent care across Oxfordshire in two secondary and tertiary care hospitals compared data during the first UK lockdown in 2020 to matched dates in 2015–2019 (Charlesworth et al., 2021). They analyzed the numbers of patients attending and inpatient diagnoses using ICD-10 classification. Total Emergency Department (ED) attendances and hospital admissions during the first UK lockdown were reduced by 56.8% and 59.4%, respectively, compared to 2015–2019. Proportions of patients hospitalized, and length of stay were similar across 2015–2020. Comparing ICD-10 diagnoses during the lockdown of 2020 ( $n = 2843$ ) to matched 2015–2019 dates ( $n = 19,946$ ) demonstrated a notable reduction in the range of diagnoses. There were 726.8 (20.4%) fewer diagnoses coded during lockdown versus 2015–2019 ( $n = 2853$  in 2020 versus mean  $n = 3569.8$  across 2015–2019). Amongst the diagnoses not coded during the lockdown, 80% were categorized as infectious diseases or their sequelae and 20% were non-specific pains/aches/malaise and accidental injury/poisonings. Among the coded diagnoses, only ‘neoplasms’ and ‘factors influencing health status and contact with health services’ increased in 2020 and significant reductions were observed for anorexia and the intentional self-harm subgroup.

An Italian cross-sectional study (Curatola et al., 2021) examined the medical charts of all children under 2 years of age admitted to the emergency department (ED) between February 2020 to February 2021 in comparison with the same period in the 5 previous years. During the outbreak of COVID-19 there was reduction of 42% emergency visits overall, while the number of bronchiolitis cases dropped by 84%. Among the children with acute bronchiolitis significantly more were admitted as “Emergency” (18.2% vs. 4.9%,  $p < .05$ ) and “High Priority Consultations” during COVID-19 (48.5% vs. 38.8%,  $p < .05$ ). No significant differences were found concerning the rate of



hospitalization, but the admission to PICU was zero compared with 4.7% in the 5 previous years ( $p < .05$ ).

Rotulo et al. (2021) describe the rate and types of community-acquired respiratory infections observed in a pediatric Emergency Department during March 10<sup>th</sup>, 2020 to April 30<sup>th</sup>, 2020 (lockdown) in Italy and compare this data the same period in 2019. The authors observed a 75.8% reduction of total number of Emergency Department consultations. Furthermore, they found a reduction in the number of children presenting with an airborne infectious disease corresponding to the 41.8% vs. 68.6% ( $p < .01$ ) of the total amount of consultations for infectious episodes in 2020 and 2019, respectively: Upper respiratory tract infections (21.4% vs. 28%,  $p < .01$ ), otitis (2.6% vs. 16.2%,  $p < .01$ ), streptococcal infections (0.5% vs. 5.2%,  $p < .01$ ) and bronchiolitis (2.1% vs. 5.7%,  $p < .01$ ) significantly decreased. Bronchitis (6% vs. 4.5%,  $p = .2$ ) and pneumonia (6.6 vs. 4.9%,  $p = .18$ ) slightly increased in March to April 2020, but not statistically significant. A significant increase both in proportions and in rates was observed for patients diagnosed with fever of unknown origin (27.8% vs. 11.1%,  $p < .01$ ), infectious mononucleosis (2.6% vs. 0.4%,  $p < .01$ ), urinary tract infection (7.4% vs. 2.9%,  $p < .01$ ) and appendicitis (6.8% vs. 1.1%,  $p < .01$ ). The rate of hospitalization significantly increased for patients presenting with fever of unknown origin (51.4% vs. 32.4%,  $p < .01$ ), bronchitis (26% vs. 8.2%,  $p < .01$ ), pneumonia (72% vs. 41.2%,  $p < .01$ ), urinary tract infection (67.8% vs. 42.5%,  $p < .01$ )."

Regarding acute pediatric trauma referrals in 2020, the large drop and origin of injuries are worthwhile to point out. Sugand et al. (2020) (UK) observed a significant reduction of 68% in pediatric injuries and a decreased risk and odds ratios of sporting-related mechanism of injuries (RR 0.55; OR 0.43). They also observed a change in general demographic of those presenting with injuries with a significantly younger median age ( $p = .02$ ) in 2020 and more girls.

Emergency visits and radiological diagnoses of fractures have decreased significantly in a German radiology department in <18-year-olds compared to the expected number of consultations ( $p < .001$ ) with a significant reduction of elbow, knee, and ankle fractures (Jungmann et al., 2021). Paiva et al. also found a significant decrease in trauma admissions (school accidents and sports accidents), while wounds, falls, burns, and dog bites increased ( $p < .001$ ). Molina Gutiérrez et al. (2020) (Spain)



report a high ranking of traumatic injuries among the overall cases in their pediatric emergency department irrespective of the confinement at this time, underlining that "the home is a frequent setting of accidents in children".

This conclusion is supported by an Italian study on emergency department visits, which dropped by more than 76%, from 17'168 in 2019 to 4'088 in 2020. However, the data point to a relative increase in ingestion cases, from 1% to 2% of overall cases, and a five times higher likelihood of admittance for ingestion in 2020 than 2019. Children with ingestions were on average 3.7 years old ( $SD = 2.6$ ). In 2020, caustic substances, drugs, batteries and sharp objects were more common and ingestions led to more serious triage codes, admission, and endoscopy (Bucci et al., 2021).

A study of the Poison Control Center (PCC) investigated characteristics and the management of calls during March to May 2020 (lockdown) and compared the data with same time period in 2019 (Milella et al., 2021). Calls from hospitals/ED decreased (14.0%, 95% CI; 11.0 – 17.4% vs. 33.5%, 95% CI; 29.6 – 37.6%;  $p < .001$ ) and calls from private Citizens increased (86.0%, 95% CI; 82.5 – 89.0% vs. 66.5%, 95% CI; 62.4 – 70.4%) compared to 2019. Calls due to exposures increased (79.3%, 95% CI; 75.1 – 82.7% vs. 72.0%, 95% CI; 68.1 – 75.6%) while simple information requests decreased. Among all exposures referrals to the ED, the referral of pre-school children ( $\leq 6$  years old) increased compared to the prior year (11.6%, 95% CI; 6.3 – 19.0% vs. 2.5%, 95% CI; 0.5 – 7.1%;  $p = .001$ ) and in two-thirds (66.7%) to the indication for referral was ingestion

An analysis of characteristics of violent events before and after lockdown stratified by injury location revealed no significant changes among subgroups for injury at home in a study from the UK (Shepherd et al. 2021). However, for injury outside the home significant decreases were found in emergency department visits by female individuals younger than 18 years and by male individuals in all age groups, those injured with weapons, and those, in which the perpetrator was a stranger, acquaintance, or security officer.

An international study (Papadopoulos et al., 2020) evaluated that 47% of the participants reported that their clinics did not accept/receive new patients during the epidemic (exception participants from Asia). Between 39% and 60% of the participating practices have even ceased physical

appointments. In addition, there is also a reduction in the frequency and/or the total number of patients monitored (median 35 cases (IQR, 20 – 60)). Ninety percent of the participating centers have launched virtual online or telephone consultations to substitute or complement clinical visits, while 73% have used a helpline to address the needs of their patients. Within each practice, a median of 70% (IQR, 60% – 80%) of evaluated patients were well controlled.

#### Impact on self-injury

Regarding self-harm, a study on hospital presentations in England by Hawton et al. (2021) showed that during the first 12 weeks following the introduction of lockdown (23.03.2020 – 14.06.2020), the average weekly number of self-harm presentations was 30.6% lower than in the pre-lockdown period (06.01.2020 – 22.03.2020) and 37% lower during the equivalent period in 2019 (23.03.2019 – 14.06.2019). Compared pre-post-lockdown 2020, the reduction appeared to be more marked for presentations involving self-poisoning compared with self-injury. Furthermore, the reduction was greater in females than males, and with it was greater in 18- to 34-year-olds (presentations were reduced by 43.8% in that age group) than in older adults

#### Physical, sexual abuse

An increase of cases was evidenced in a retrospective analysis of referrals from a hospital's children's social care (CSC) in the UK (1<sup>st</sup> April to 30<sup>th</sup> June 2020) compared to data from the same period in 2018 and 2019. Referral to CSC and multi-agency strategy meetings were used as an indicator of verifiable safeguarding concerns. It indicated an increase of children admitted under all categories (31%). A 69% increase in the number of referrals for suspected physical abuse was noted with strategy meetings convened in 44%. During the study period, there was an increasing number of children falling from a building of at least one floor high. Analysis of this cohort from March 20<sup>th</sup>, 2020 (first day of school closure) to July 19<sup>th</sup> showed that eight children were admitted for tertiary neurosurgical care, representing a threefold increase compared with the same period in 2018 and 2019 (2 and 2 to 8,  $p = .0001$ ). Of this cohort, 38% (3/8) were under 2 years (Masilamani et al., 2021).

[Katz et al. \(2021\) discuss the impact of COVID-19 on child maltreatment reports and child protection services responses by comparing countries \(among others Germany\) using various data](#)

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sources: hospitals reporting increased numbers of conspicuous injuries, which may be related to maltreatment; the youth welfare portal ([www.jugendhilfeportal.de/](http://www.jugendhilfeportal.de/)) reporting an increase of 5.6% of counselling calls on the child & youth line from March to April 2020, a large representative survey of the Technical University of Munich (TUM) on domestic violence during the pandemic showing that in 6.5% of all households children were punished violently, and a NGO estimating an up to 30% increase in demand for child pornography in the European Union during the pandemic (ReliefWeb, 2020). Further, Katz refers to a study performed by a major newspaper and radio station (Hell et al., 2020) yielding no increase in reported cases of child abuse during the lockdown. A review by Jentsch and Schnock (2020) cites a report by the German Youth Welfare (Mairhofer et al., 2020): 55% of participating welfare institutions indicate no change of reporting and 25% a reduction. Only 5% reported an increase in the number of reports, but many welfare-experts believe that reporting was made more difficult due to the public health measures (Jentsch et al.).

## What impact do the pandemic and the containment measures have on mental health of children, adolescents, and young adults?

### Summary

Children, adolescents, and young adults are worried. Almost all high school students in Switzerland were afraid of infecting their parents/grandparents or another close person belonging to a risk group and about one third of respondents to the Swiss Corona Stress Study have at least a moderate to severe fear of suffering from Long-COVID in case of infection. 15- to 34-year-olds also indicated that the fear of the future had become particularly important to them. Generally, children, adolescents and young adults miss their social contacts and peers and report increased feelings of loneliness, but adolescents and young adults seem to be affected even more. Particularly those with general psychopathology symptoms reported increases in worries and anxiety. The fact that sharing thoughts and feelings about COVID-19 with others was the most frequently reported coping strategy for COVID-19-related problems also highlights the importance of social contacts as a coping strategy to sustain one's mental health. About half of young adults reported to use this strategy, whereby females mentioned it more frequently than males.

Particularly during the first lockdown period but also during the second wave in November 2020, and the third wave in March 2021, the psychological well-being [and global health](#) of children, adolescents, and young adults decreased, and distress, anxiety, depression, and general psychopathology increased with up to a third exceeding the cut-off levels for clinically relevant symptoms. For instance, during the lockdown, over a third of a UK student sample could be classified as clinically depressed at lockdown compared to 15% at baseline. During November 2020, 18% of the adolescents and young adults who participated in the Swiss Corona Stress Study reported moderately severe to severe depressive symptoms, with the youngest group of 14- to 24-year-olds being the most affected at 29%. Between March 8<sup>th</sup> and 24<sup>th</sup>, 2021, an additional anonymous survey of the Swiss Corona Stress Study was conducted in the German speaking part of Northwestern Switzerland among 393 high school students with the majority being between 16 and 19 years old. 27% of the respondents reported moderately severe to severe depressive symptoms with perceived school pressure being the most significant stressor associated with depressive symptoms where 46% of the respondents indicated they were very or extremely stressed because of the pressure of school. Additional correlates of depression and increased

clinical symptoms that have been found in other studies were worsened sleep quality and decreases in exercise behavior. Moreover, the quality of the diet correlated with perceived happiness and physical health, depending on school children's weight status. For young adults who were working, reduced working was associated with increased levels of distress, particularly for those employees who were self-isolating/sick, permanently laid-off or in caregiving roles. For professional athletes no differences to non-athletes were found regarding their depression, anxiety, and stress symptoms.

Regarding effects of COVID-19 related measures on newborn infants, a study pointed to increases in impaired mother-infant bonding during the pandemic.

Adolescents with current/past eating disorders reported significantly more difficulties in regulating their eating behavior and the reactivation of symptoms. Studies on alcohol consumption are inconclusive. Whereas some studies observed a reduction in alcohol consumption and that binge drinking and smoking did not increase, other studies found that the regular consumption of alcohol does seem to increase and that about one-fifth of young adults resorted to alcohol consumption either "a lot" or "very much".

The effects for children and adolescents with Attention Deficit Hyperactivity Disorder (ADHD), ASD (Autism Spectrum Disorder), as well as cystic fibrosis, primary ciliary dyskinesia, and asthma showed effects on well-being and social relations, however, there is a greater variance with respect to the direction of the effects. While some benefitted from the reduction of external demands that cause stress (e.g., tightly organized school schedules for children with ADHD or social situations for children with ASD), others experience decreases as external support is reduced (e.g., local health services, school or private therapist). For children with cancer, children's occupational performance and satisfaction both decreased significantly between April and September 2020 and their participation in neighborhood and community participation and participation in community living activities decreased. Also, Special Educational Needs and Disability families felt a lack of support and young LGBTQ+ adults were emotionally affected and felt isolated.

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Regarding the utilization of mental health services, one large-scale UK study observed that primary care contacts was decreased during March to July 2020 relative to the pre-pandemic period. This was true for anxiety, depression, self-harm (fatal and non-fatal), severe mental illness, eating disorder, and obsessive-compulsive disorder, but not for acute alcohol-related events that remained stable. Although the frequency of primary care contacts recovered it did not attain pre-lockdown levels. Another study from France also observed that compared to 2019, the number of overall and mental health specific consultations decreased in January to February 2020 (ca. 5 to 15%) and increased again in March to June (ca. 5 to 20%) with about half of the consultations in March and May and all consultation in April being teleconsultations.

**Number of publications:** 40 (26 in April, 14 in March)

**Time period:** Jan 2020 – Sept 2021, single publications from March to May, 2021.

## Results

### Worries and social contacts

A study from Italy by Buzzi et al. (2020) observed that the majority of adolescents were moderately worried in general, but less worried that their parents. Adolescents in south-central regions in Italy, which were less affected, reported greater worries than in northern regions. Containment measures were considered to be appropriate (> 90%), with 41 – 57% reporting that they adhered sometimes or always to the measurements. About 32 – 37% of the adolescents think there will be negative consequences in school education, whereby females worried more than men and 27% report that they don't know. The majority experienced changes in their social relationships with 70% indicating that they have more social network contacts but less physical meetings and 22% state that they have less of both, and 8% report no change. Worries and fears varied according to gender, age, and region.

Similarly, a study from Spain (Idoiaga Mondragon et al., 2020) observed that children have mixed emotions in lockdown; whilst they are happy and relaxed with their families, they also feel fear, nervousness, worry, loneliness, sadness, boredom, and anger. Socially, they state that they missed peers and caregivers

The cross-sectional study by Pisano et al. (2021, see above) in south Italy examined factors related to emotional symptoms during the strictest quarantine period in a convenient sample of 326

adolescents. Analyses showed that, during the quarantine, adolescents were more worried about their families getting infected ( $M = 7.2$ ,  $SD = 3.1$ ) than they were worried about themselves ( $M = 4.3$ ,  $SD = 3.6$ ),  $t(325) = 14.71$ ,  $p < .001$ . A hierarchical regression analysis revealed that general psychopathology symptoms (SDQ),  $\beta = .556$ ,  $p < .001$  and worries about infection (WI),  $\beta = .110$ ,  $p = .013$ , were both uniquely independent predictors of anxiety,  $r^2 = .425$ ,  $p < .001$ . No other significant effects were observed. That is, over and above the other variables in the model, the higher the general psychopathology symptoms before the COVID-19 and the worries about the infection, the higher the state anxiety during the quarantine was (Pisano et al., 2021).

The study by Evans et al. (2021, see above) used longitudinal data from 2019 (baseline, pre-pandemic) and April/May 2020 (under 'lockdown' conditions) to characterize effects on mental health and behavior in a sample of 254 UK undergraduate students. They observed that the self-reported levels of worry surrounding contracting COVID-19 were high (Evans et al., 2021)

In a study in Greece, young adults ( $N = 1559$ , 18 - 30 years) reported to share thoughts and feelings about COVID-19 with others "a lot" or "very much" (50.6%) to cope with COVID-19-related problems. Thereby, female respondents showed a significantly greater tendency towards sharing thoughts and feelings with others than male respondents (Golemis et al. 2021).

An additional survey of the Swiss Corona Stress Study provided insights the distress of adolescents and young adults in the German speaking part of Northwestern Switzerland between March 8<sup>th</sup> and 24<sup>th</sup>, 2021 (Quervain et al., 2021). 393 high school students participated in the anonymous survey with the majority being between 16 and 19 years old. Most of respondents said they were afraid of infecting their parents/grandparents or another close person belonging to a risk group while only 4% indicated that they were not at all afraid. Moreover, 29% of respondents have at least a moderate to severe fear of suffering from Long-COVID in case of infection.

The report "Atlas der Emotionen. Die neue Gefühlslandkarte der Schweiz" by Bosshardt et al. (2020) is based on the Swiss campaign "Wie geht es dir?" ["How are you?"] for the promotion of mental health, which is carried out by the cantons and Pro Mente Sana on behalf of Health Promotion Switzerland. Amongst others, the report shows which emotions and feelings have gained or lost importance as a result of the corona crisis. The results show that the negative impact of the corona pandemic on mood was most pronounced among participants aged 15 to 24 years. Overall,



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60% in this age group reported that the corona pandemic had a negative impact on their mood. Younger respondents also indicated fewer feelings overall that had gained importance for them compared to the older respondents. In addition to the positive feelings of "gratitude" and "satisfaction," "fear of the future" has become particularly important among the 15- to 34-year-olds.

Z-Proso is a longitudinal study from Switzerland (Averdijk et al., 2020), which started at 2004. It examines the life of young people in Zurich with the aim to better understand the impacts of the changes in society on this age group. The original participants are now around 22 years old. Most 22-year-olds followed the BAG recommendations: 90% said, for example, they avoided public transport and groups of people. Support for social distancing declined rapidly, from 65% at the beginning of April 2020 to less than 40% at the end of May 2020. The Corona crisis severely disrupted the lives of 57%, while 26% did not feel that their lives were very much affected. With the gradual lifting of the regulations in May 2020, about four out of ten participants said that their lives had been severely disrupted, while one in three said that his/her life had not been seriously affected. As the crisis progressed, so did the general well-being of young people. In April 2020, about a third said they had felt worse because of the crisis, while 18% felt better. When the easing of measures began, the participants' feelings improved. By the end of May 2020, the percentage of participants who had felt worse about themselves dropped to 15 %, while those who had felt better since the start of the crisis rose to a third. More than half of the participants were working or studying from home in April and May 2020.

### Psychological distress and loneliness

The Swiss Corona Stress Study provided insights the distress of adolescents and young adults (Quervain et al., 2021). The last survey of the Swiss Corona Stress Study in November 2020 has shown that the proportion of respondents with moderately severe to severe depressive symptoms was 18%, with the youngest group of 14- to 24-year-olds being the most affected at 29%. Between March 8<sup>th</sup> and 24<sup>th</sup>, 2021, an additional anonymous survey was conducted in the German speaking part of Northwestern Switzerland among 393 high school students with the majority being between 16 and 19 years old. 27% of the respondents reported moderately severe to severe depressive symptoms. The most significant stressor associated with depressive symptoms was perceived school pressure. 46% of the respondents indicated they were very or extremely stressed because

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of the pressure of school. Furthermore, the perception that school pressure has increased due to the pandemic (missed material due to closures, quarantine) was strongly correlated with depressive symptoms. Other factors included worries about poorer education or job opportunities and worries about damage to the social network. An additional factor analysis confirmed that stressors related to school build up the factor with the strongest correlation with depressive symptoms (with a large effect size).

A Swiss study by Ehrler et al. (2021) at the University Children's Hospital Zurich investigated children with increased risk of neurodevelopmental impairment (children with congenital heart disease = 73, children born very preterm = 54) aged 10 to 16 years in comparison to typically developing children (TD = 73) and provides pre-and in lockdown data on well-being and family functioning. They observed a small to medium effect that psychological well-being decreased ( $B = -5.05$ , 95% CI;  $-6.63 - -3.47$ ,  $p < .001$ ), independent of group. During the pandemic, psychological well-being was significantly lower than the norm ( $M = 45.6$ , 95% CI;  $44.01 - 47.14$ ,  $p < .001$ ) whereas it had not differed from the norm before the pandemic ( $M = 50.6$ , 95% CI;  $49.06 - 52.08$ ,  $p = .458$ ). A third of the children lay below the norm threshold compared to 11% prior the pandemic. Parent relationship and autonomy did not differ from the norm at either time point (Ehrler et al., 2021).

Luijten et al. (2021) conducted a cross-sectional, population-based study in the Netherlands on the mental/social health of children/adolescents during the COVID-19 lockdown. They compared two representative samples of Dutch children/adolescents (8 to 18 years) before COVID-19 (2018,  $N = 2401$ ) and during lockdown (April 2020,  $N = 844$ ) on the Patient-Reported Outcomes Measurement Information System (PROMIS) domains. Compared to before (absolute mean difference range 2.1–7.1 (95% CI; 1.3 – 7.9), more children reported severe anxiety (RR = 1.95 (1.55 – 2.46) and fewer children reported poor global health (RR = 0.36 (0.20 – 0.65)). Associated factors with worse mental/social health were single-parent family, three children in the family, negative change in work situation of parents due to COVID-19 regulations, and a relative/friend infected with COVID-19. A large majority (>90%) reported a negative impact of the COVID-19 regulations on daily life.

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An Irish study (Ferry et al., 2021) aimed to examine how reduced working impacted mental health in the early months of COVID-19. The collected data included pre-pandemic data from January/February 2020 and data from April 2020. 8,708 individuals/employees between 18 and 65 years were analyzed. 42.2% of the employees reported reduced working in April 2020. Whereas reduced working per se was not associated with psychological distress in April 2020 (OR = 1.06, 95% CI; 0.91 – 1.23), employees self-isolating/sick, permanently laid-off or in caregiving roles were more likely than other employees to be distressed (OR = 1.67, 95% CI; 1.13 – 2.47; OR = 4.93, 2.24 – 10.87; OR = 1.87, 1.28 – 2.73 respectively). Compared to January/February 2020, psychological distress in April 2020 was increased from 20.1% to 31.8% and reduced working was associated with greater psychological distress (OR = 1.30, 95% CI; 1.14 – 1.49). Females and those not living in a couple were also more likely to report psychological distress (OR = 2.09, 1.82 – 2.40 and OR = 1.70, 1.47-1.96 respectively). Older age (OR = 0.44, 0.33-0.59 for those aged 45 to 54 years) and higher baseline weekly household earnings (OR = 1.08, 1.01-1.17) appeared to be protective.

This Turkish study (Şenışık et al., 2021) aimed to explore whether the mental health status of professional athletes was affected by the isolation period, in which organized sports were suspended due to the COVID-19 pandemic. A total of 571 participants between the ages of 18 and 38 ( $M = 24.53$ ,  $SD = 5.09$ ,  $n_{\text{males}} = 372$ ,  $n_{\text{females}} = 199$ ) including 97 individual athletes, 295 team athletes and 179 non-athlete controls completed the study. Depression and anxiety symptoms were lower in athletes compared to non-athletes ( $p < .05$ ). Depression, anxiety, and stress symptoms were similar in team athletes and individual athletes ( $p = .232$ ,  $p = .444$ , and  $p = .116$ ; respectively). The post-traumatic stress symptoms were lower in male team athletes than female team athletes ( $p = .020$ ) and non-athletes ( $p < .001$ ). Depression, anxiety, and stress symptoms were found to be similar in men and women ( $p > .05$ ). There was a negative correlation between physical activity level and mental health symptoms ( $p < .05$ ) suggesting that sport represented a protective factor.

The 6. SRG Corona-Monitor from "Forschungstelle sotomo" (Bosshard et al., 2021) was published at the 15.01.2021 and describes different aspects on the impact of COVID-19 on swiss daily life. Fear of social isolation and loneliness was reported to be on the rise and to have reached a new high. More than half of the respondents were personally afraid of this. With the tightening of the

measures, fear of social isolation and loneliness was said to become a major social challenge in the coming weeks and months. Regarding the duration of restrictions, the population's assessment of the question of when it will be possible to move around Switzerland without restrictions again, is shifting further and further into the future. Most people now assume that normality will not return until the end of 2021.

A study from the UK (Niedzwiedz et al. 2021) found that psychological distress increased 1 month into lockdown with the prevalence rising from 19.4% (95% CI; 18.7% – 20.1%) in 2017–2019 to 30.6% (95% CI; 29.1% – 32.3%) in April 2020 (RR=1.3, 95% CI; 1.2 – 1.4). Groups most adversely affected included women, young adults, people from an Asian background and those who were degree educated. They also observed that loneliness remained stable overall (RR=0.9, 95% CI; 0.6 – 1.5) but repeated cross-sectional analyses revealed that there were differences by age group, with younger people experiencing higher overall levels of loneliness, as well as a large increase in loneliness, from 13.3% (95% CI; 11.6 – to 15.3) to 20.2% (95% CI; 16.0 – 25.2) during lockdown.

The study by Evans et al. (2021) used longitudinal data to characterize effects on mental health and behavior in a UK student sample, measuring sleep quality and diurnal preference, depression and anxiety symptoms, wellbeing and loneliness, and alcohol use. Self-report data was collected from 254 undergraduates (219 females) at a university at two-time points: autumn 2019 (baseline, pre-pandemic) and April/May 2020 (under 'lockdown' conditions). Longitudinal analyses showed a significant rise in depression symptoms ( $p = <.001$ ) and a reduction in wellbeing ( $p = <.001$ ) at lockdown. Over a third of the sample could be classified as clinically depressed at lockdown compared to 15% at baseline. The increase in depression symptoms was highly correlated with worsened sleep quality ( $p = <.001$ ) (Evans et al., 2021).

A multi-country cross-sectional (UK, IRE, NZ and AUS;  $N = 8425$ ,  $M = 44.5$  years,  $SD = 14.8$  years; 70.7 % female and 93.8% white) study examined physical activity (IPAQ-SF), depression, anxiety and stress (DASS-9) and well-being (WHO-5) in the early phase of the COVID-19 restrictions of each country in >18-year-olds. Younger people (18 to 29 years) reported more negatives changes (26.1%) than all other age groups (between 11.1% -19.1%,  $p = <.001$ ) in their exercise behavior. Individuals who had a negative change in their exercise behavior between before and during initial

COVID-19 restrictions reported poorer mental health and well-being; a relationship that was evident across all countries investigated (Faulkner et al., 2021).

A longitudinal study in Spain examined the effects of the pandemic and confinement on the mental health of the general population over 18 years. Data was collected from March 21<sup>st</sup> to June 4<sup>th</sup>, 2020 at three time points: two weeks after the beginning of the confinement ( $N = 3480$ ), after a month ( $N = 1041$ ) and after two months, when the lockdown was lifted ( $N = 569$ ). The results show that depressive symptoms increased significantly throughout the confinement ( $Z(T0-T1) = 7.06, p < .001$ ), slightly decreased ( $Z(T1-T2) = 1.34, p = .372$ ) and were reduced by the third evaluation ( $Z(T0-T2) = 4.02, p < .001$ ). In the regression model for depression in which 42 % of the variance could be explained, younger age was one of the main predictors, amongst spiritual well-being and loneliness. In the case of anxiety, the model explained 31% of the variance of the fixed effects, with spiritual wellbeing, loneliness, younger age and female gender as the main predictors. This result indicates that younger age is a predictor of depressive symptomatology during the pandemic (González-Sanguino et al., 2021).

The cross-sectional study by Pisano et al. (2021, see above) in south Italy examined factors related to emotional symptoms during the strictest quarantine period. The researchers collected data from a convenient sample of 326 adolescents ( $M_{males} = 18.8$  years,  $SD = 1.3$ ;  $M_{females} = 16.0$  years,  $SD = 1.4$ , 24.2%). used a web-based online survey. The assessment of state anxiety symptoms during the COVID-19 using the state and trait anxiety inventory (STAI) revealed that the adolescents had a mean score of 41.6 ( $SD = 10.8$ ); considering the cut-off of 40 as predictive of clinically relevant symptoms, data showed that the 47.5% of the sample exceeded it; specifically, 27.0% showed “mild anxiety”, 14.1% showed “moderate anxiety” and 6.4% “severe anxiety”. A significant gender difference was observed,  $t(324) = 5.74, p < .001$ , with females showing higher state-anxiety (S-A) than males. The assessment of depressive symptoms during the COVID-19 using the MFQ-SF revealed that adolescents had a mean score of 6.5 ( $SD = 5.6$ ); considering the cut-off of 12 as predictive of clinically relevant symptoms, data showed that 14.1% of the sample exceeded it. A significant gender difference was observed,  $t(324) = 6.89, p < .001$ , with females showing higher depression (MFQ-SF) than males. The assessment of the presence of general psychopathology symptoms using the (SDQ) referred to the 6 months (thus before the onset of pandemic) showed

that adolescents had a mean total score of 11.4 ( $SD = 5.9$ ); considering a cut-off score of 14, data indicate that 26.7% of the sample exceeded it; specifically, 9.2% showed a “slightly raised” score, 6.1% showed a “high” score, 11.3% showed a “very high” score. A significant gender difference was observed,  $t(324) = 5.80$ ,  $p < .001$ , with females showing more symptoms (SDQ) than males. Data from the hierarchical regression analysis showed a similar pattern of effects for the two considered dependent variables. The parameters of the final model revealed that general psychopathology symptoms (SDQ),  $\beta = .556$ ,  $p < .001$  and worries about infection (WI),  $\beta = .110$ ,  $p = .013$ , were both uniquely independent predictors of anxiety,  $r^2 = .425$ ,  $p < .001$ . No other significant effects were observed. That is, over and above the other variables in the model, the higher the general psychopathology symptoms before the COVID-19 and the worries about the infection, the higher the state anxiety during the quarantine was. In addition, the final model revealed that gender,  $\beta = -.103$ ,  $p = .012$ , general psycho-pathology symptoms (SDQ),  $\beta = .625$ ,  $p < .001$ , environmental context (EC),  $\beta = -.106$ ,  $p = .005$ , and changes in lifestyle (CL),  $\beta = .108$ ,  $p = .006$  were all uniquely independent predictors of depression,  $r^2 = .569$ ,  $p < .001$ , and that the amount of changes in lifestyle (CL) moderated the relation between the general psychopathology and the depression scores. Females showed a higher level of depression than males, such that more general psychopathology symptoms before the COVID-19 were related to higher depression during the quarantine (Pisano et al., 2021).

A cross-sectional study in 116 Spanish 8- to 12-year-old schoolchildren ( $M = 10.22$ ,  $SD = 1.20$ ) showed no differences in the perception of loneliness, happiness, or health, quality of diet, or anthropometric variables ( $p > .005$ ) between boys and girls with the exception that boys were heavier than girls ( $p < .005$ ). Higher values in the quality of diet correlated with higher scores in perceived happiness and health ( $p < .005$ ). Linear regression showed an association between quality of diet and perception of happiness after the model was adjusted for normal weight ( $r^2 = .382$ ;  $p < .005$ ). Likewise, it showed a significant association between quality of diet and perception of health after the model was adjusted for overweight schoolchildren ( $r^2 = .455$ ;  $p < .005$ ). The association between perceived health and happiness with quality of diet seems to be moderated by weight status (Carrillo Lopez et al., 2021).



A Portuguese study from Fernandes et al. (2021) aimed to explore the impact Covid-19 has on maternal mental health and mother–infant relationships during the postpartum period. Results show that mothers ( $N = 567$ ) who gave birth during the pandemic presented lower levels of emotional awareness of the Child and a more impaired mother–infant bonding than those mothers who gave birth before the pandemic. Impaired mother–infant bonding was positively and significantly associated with more perceived postpartum difficulties due to the implementation of the state of emergency ( $r_{pb} = 0.14, p < .001$ ) and whether the baby's birth was before or during COVID-19 ( $r_{pb} = 0.09, p < .005$ ). Moreover, impaired mother–infant bonding was positively and significantly associated with anxious symptoms ( $r = 0.28, p < .001$ ), depressive symptoms ( $r = 0.36, p < .001$ ), and parenting stress ( $r = 0.66, p < .001$ ) (Fernandes et al. 2021).

#### Eating disorders and/or substance abuse (alcohol, cannabis, prescription drugs, drugs)

A study from Spain (Graell et al., 2020) reported that during the study period from March 16 to May 10, 2020, 41.9% of patients reported reactivation of eating symptoms. Thereby, adolescents presented a more pronounced reactivation of eating disorder and non-eating disorder symptoms than children. They outlined that the swift establishment of a combined teletherapy program has allowed continuity of the outpatient treatment and partial continuation of the day hospital, managing the reactivation of eating symptoms and general psychopathology produced during this exceptional time.

A study from Robertson et al. (2021) aimed to explore maladapted eating behaviors by asking about perceived changes in eating behaviors, exercise and body image during the lockdown in the UK in adults over 18 years ( $N = 264$ ). The authors conducted the study between 11<sup>th</sup> May and 26<sup>th</sup> June, 2020 and compared the extent of perceived changes. The results show that younger people (under 30 years) were more likely to report thinking more about exercise ( $\chi^2(1) = 12.20, p < .001$ ) and being concerned about their appearance ( $\chi^2(1) = 12.57, p < .001$ ), however there were no statistical significant differences by age group in perceived changes to eating or exercising behavior. People with current/past eating disorders reported significantly more difficulties in regulating eating (Robertson et al. 2021).



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With respect to alcohol abuse, a study from the UK (Niedzwiedz et al. 2021) observed that in 18- to 24-year-olds binge drinking remained unchanged but that the proportion of those who are drinking four or more times per week increased. With respect to smoking, they observed that current smoking declined.

A study by Evans et al. (2021, see above) used longitudinal data to characterize effects on mental health and behavior in a UK student sample, measuring sleep quality and diurnal preference, depression and anxiety symptoms, wellbeing and loneliness, and alcohol use. Comparing self-report data from 254 undergraduates (219 females) at a university in autumn 2019 (baseline, pre-pandemic) and April/May 2020 (under 'lockdown' conditions), a reduction in alcohol use ( $p = <.001$ ) was observed.

In the Greek study that examined how young adults ( $N = 1559$ , 18 - 30 years) coped with COVID-19-related problems, 21.1% reported that they resorted to alcohol consumption either "a lot" or "very much". Female respondents showed a stronger resistance to resorting to alcohol to cope with COVID-19-related stress compared with males (Golemis et al. 2021).

Further reviews on the impact of the COVID-19 pandemic on psychiatric disorders remained speculative but suggested increases in post-traumatic stress, depression, and anxiety due to the COVID-19 pandemic (Guessoum et al., 2020; Imran et al., 2020).

#### Impact on the utilization of mental health services (hospitalizations or mental health emergencies)

A study in the UK by Mansfield et al. (2021) examined primary care contacts for almost all conditions using de-identified electronic health records from the Clinical Research Practice Datalink (CPRD) Aurum (2017  $N_{11-20} = 1'233'387$ ,  $N_{21-30} = 1'455'550$ ; 2018  $N_{11-20} = 1'283'296$ ,  $N_{21-30} = 1'499'066$ ; 2019;  $N_{11-20} = 1'319'983$ ,  $N_{21-30} = 1'517'439$ ; 2020  $N_{11-20} = 1'325'412$ ,  $N_{21-30} = 1'505'172$ ). They observed that between 2017 and 2020, weekly primary care contacts for selected mental health conditions: anxiety, depression, self-harm (fatal and non-fatal), severe mental illness, eating disorder, obsessive-compulsive disorder, acute alcohol-related events. Primary care contacts included remote and face-to-face consultations, diagnoses from hospital discharge letters, and secondary care referrals, and conditions were identified through primary care records for diagnoses, symptoms, and prescribing. Their overall study population included individuals aged 11 years or

older who had at least 1 year of registration with practices contributing to CPRD Aurum in the specified period, but denominator populations varied depending on the condition being analyzed. An interrupted time-series analysis was used to formally quantify changes in conditions after the introduction of population-wide restrictions (defined as March 29<sup>th</sup>, 2020) compared with the period before their introduction (defined as Jan 1, 2017 to March 7, 2020), with data excluded for an adjustment-to-restrictions period (March 8<sup>th</sup> to 28<sup>th</sup>). [...] Primary care contacts for almost all conditions dropped considerably after the introduction of population wide restrictions. The largest reductions were observed for contacts for depression (OR 0.53 [95% CI; 0.52–0.53]) and self-harm (OR 0.56 [95% CI; 0.54–0.58]). In the interrupted time-series analysis, with the exception of acute alcohol-related events (OR 0.98 [95% CI; 0.89–1.10]), there was evidence of a reduction in contacts for all conditions (anxiety OR 0.67 [95% CI; 0.66–0.67], eating disorders OR 0.62 [95% CI; 0.59–0.66], obsessive-compulsive disorder [OR 0.69 [95% CI; 0.64–0.74]], self-harm OR 0.56 [95% CI; 0.54–0.58], severe mental illness OR 0.80 [95% CI; 0.78–0.83]. By July 2020, except for unstable angina and acute alcohol-related events, contacts for all conditions had not recovered to pre-lockdown levels (Mansfield et al., 2021).

Carriere et al. (2021) report on the adaptation of care provision and consultations frequency in a "Maison de adolescents" which addresses different needs of adolescents and their families including ambulatory consultations, day hospital and an in-patient unit during the first half of 2020. Compared to 2019, they reported a drop in overall and mental health specific consultations in January to February (ca. 5 to 15%) and an increase in Mars to June (ca. 5 to 20%). About half of the consultations in March and May and all consultation in April were teleconsultations.

#### Psychological abuse

The studies by Shepherd et al. (2021) (UK) and Masilamani et al. (2021) that are described in the section on "physical health" investigate abuse without specifically differentiating between physical and psychological abuse, (see also Đapić et al., 2020).

#### Impact on well-being and social contact in children with ADHD

In total, answers of 533 parents of children with ADHD were included in the analysis of this study from France. The vast majority of responders were women 95% (95% CI; 93.50; 97.18), children

mean age was 10.5 (95% CI; 7.58 – 13.44). Since the lockdown, 34.71% of children experienced a worsening in well-being, 34.33% showed no significant changes and 30.96% (95% CI; 27.09 – 35.10) were doing better according to their parents. The thematic analysis showed that an improvement of their children's anxiety was one of the main topics addressed by parents. This improvement related to less school-related strain and flexible schedules that respected their children's rhythm. Improved self-esteem was another topic that parents linked with a lesser exposure of their children to negative feedback (e.g. in school environment). On the other hand, parents reported a worsening of general well-being in their children, and this manifested as oppositional/defiant attitudes and emotional outbursts (both can be typical for behavior in the context of "ADHD"). In addition, doing school-task at home and learning for school was difficult for some children, according to their parents. The lockdown situation raised parents' awareness of the role of inattention in relation to ADHD symptoms in the context of their children's learning difficulties. Furthermore, a "shift to the digital" world has been described, children suffered from not being able to meet their classmates in person, hence their spending more time on social media and playing video games (Bobo et al., 2020).

#### Autism Spectrum Disorder: Well-being and social contact

Autism Spectrum Disorder (ASD) individuals are vulnerable to routine disruption. In line with the assumption that COVID-10 outbreak disrupted their routines, a study in Italy (Colizzi et al., 2020) found that behavior problems were reported to be more intense (35.5%) and more frequent (41.5%) in a substantial proportion of ASD individuals, compared to before the COVID-19 outbreak. Thereby, ASD individuals with behavior problems predating the COVID-19 outbreak were twice as likely to experience more intense and more frequent behavior problems.

Also, a study from Spain (Mumbardó-Adam et al., 2021) observed that some children with ASD were more irritable because of the unpredictability of the situation. However, in their study, the majority of the responding families with a child with ASD highlighted that their children were happier than before quarantine. "Families observed that their children were more communicative, participated more often in family routines, and in choice-making decisions regarding family activities. The majority seemed to be comfortable with the situation and did not often asked to go back to school or to previous routines. Families also benefited from this extra time with their sons

and daughters to teach new skills related to their autonomy, to house care routines, and perhaps more importantly, to social skills and communicative interaction. The external support seems to play an important role for the experiences of children with ASD and their families. In the study by Mumbardó-Adam et al., families appreciated to have school and online psychological support, and truly valued their cohesion and online contact with relatives during quarantine. However, they also claimed for social comprehension regarding their children special needs during quarantine (such as going out for a walk), more flexibility at their workplaces to better conciliate with their family life, and they would also have appreciated a more continued educational support, and a more tailored monitorization of school activities (Mumbardó-Adam et al. 2021).

Similarly, Colizzi et al. report that parents claimed frequent support from local health services, school and private therapist, whereby support by local healthcare service was rated as less useful than school and therapist. In addition, not receiving school support was associated with more intense behavior problems. Parents reported difficulties in managing their child's meals (23%), autonomies (31%), free time (78.1%), and structured activities (75.7%) and one out of four parents stopped working due to the outbreak. These findings also complement the findings on pediatricians' changed clinical practice with a focus on the necessary maneuvers (Monzani et al., 2020).

Lugo-Marin et al. (2021) assessed mental health of children or adolescents with ASD in Spain ( $M_{age} = 10.7$ ;  $SD_{age} = 3.4$ ). 37 caregivers reported that the overall psychopathological status of the children and adolescents after the lockdown start to be relatively stable. However, compared to the pre-pandemic period, symptoms as assessed by the Child Behavior Checklist (CBCL) increased with no subscale (anxious/depressed; social problems; thought problems; attention problems) being significantly lower after the lockdown start. Regarding the perception of changes in daily functioning areas, caregivers reported that they perceived a significant improvement ( $\geq 45\%$ ) only in feeding quality (49%), whereas they reported significant worsening for mood/irritability (57%), and a lower number of social initiations (49%).

The French ELENA cohort in children with ASD (Berard et al., 2021) investigated the effects of containment and mitigation measures primarily on the behavior of children and youth (CaY) with Autism Spectrum Disorders (ASD). and secondarily explored risk and protective factors on behavior

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change including sociodemographic variables, living conditions, ASD symptom severity and continuity of interventions. 239 parents of cohort participants, 2 to 21 years of age, took part in the study. With regards to sleep, communicative abilities, and stereotyped behaviors, about half the parents (respectively 55.5% ( $n = 131$ ), 57.2% ( $n = 135$ ) and 54.7% ( $n = 129$ )) reported no changes during confinement. When a change was reported in these domains, the behavior was more often perceived as worsening than improving, except for communication in which about a third of the parents reported progress (28.8%,  $n = 68$ ). Regarding nutrition behavior, the majority of parents (71.6%,  $n = 169$ ) reported no change in nutrition behaviors, one fifth reported a worsening. Most parents, however, (64.4%,  $n = 152$ ) reported increase in challenging behaviors during confinement. The study also indicates that one-third of the parents kept their children in confinement longer than measures requested due to fear of infection. As for protective factors significantly associated with behaviors, the study indicates that chances of reporting improvement was higher in younger participants or with a lower severity score. The interventions from special education services or private professionals were maintained for three quarters of the CaY using telephone or telehealth services. Results yield that subjects for whom interventions were maintained during COVID-19 showed more progression of communication skills (86.8%,  $n = 59$ ). Finally, the variability of responses was higher in single-family parent families, and communicative abilities regression (30.3%,  $n = 10$ ) was higher than progression (13.2%,  $n = 9$ ,  $p = .04$ ). (Berard et al., 2021)

A mixed-method study from Turkey (Meral, 2021) investigated different aspects of the effects of lockdown due to the Covid-19 pandemic on the family functioning of children with ASD and Developmental Disorders (DD). The author collected qualitative and quantitative data from 32 parents of children with ASD and DD by using video calls or phone chats between April 13<sup>th</sup>, 2020 and May 9<sup>th</sup>, 2020. Most parents reported that they took basic precautions including isolation, not going outside, and/or limited interaction to cope with the Pandemic (50%). As negative impacts of the pandemic for the family only a minority of parents expressed that they experienced conflict among family members (15.6%). As positive effects, more than half of the participants (56.2%) reported having more time to share with the child and doing something together as a positive experience. Also 34.3 % reported an increase in father-child interaction because they had to stay at home during the lockdown. 40.6% of the parents reported unmet educational needs and 31.2% reported isolation and no or limited interaction with peers as negative effects for the child with ASD

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or DD. On the other hand, increased verbal behavior due to increased family interaction was reported by a quarter of the parents. For the quantitative part of the study, the parental perception of family distress was rated on a low level (3.03 / 10;  $SD = 1.57$ ), while the participants were satisfied with the family quality of life (6.96 / 10,  $SD = 1.61$ ) and were moderately happy (3.56 / 5,  $SD = 0.75$ ).

#### Children with psychiatric disorders

A longitudinal study in a French university clinic investigated the stability respectively the improvement or deterioration of the mental health status of children with psychiatric problems that have been treated in their ambulant offers from March 16<sup>th</sup> to May 10<sup>th</sup>, 2020 (age 3 to 18,  $N = 354$ ). Doctors established the status using a common method (Clinical Global Impression Improvement) on a weekly basis. Most children's and adolescents' mental health status remained stable of the course of the 8 weeks. 23 to 33 % of patients showed an improvement over the course of the weeks, albeit the majority a minor improvement, and 22 to 30% showed a deterioration, again mostly minor deterioration of their mental health status (Lavenne-Collot et al., 2021).

#### Children with cancer diagnoses

In a longitudinal study from Turkey (Güney et al., 2021), the authors analyzed occupational performance (OP) and participation levels of children with cancer during the COVID-19 and the quarantine period. The sample included a total of 67 children and their parents (male: 55.2%, female: 44.8%; mean age: 9 years,  $SD = 1.5$ ). Whereas home participation didn't change statistically, children's occupational performance (self-care, productivity, and leisure activities; Canadian Occupational Performance Measure) and satisfaction both decreased significantly between the two measured time-points, April and September 2020 (OP:  $Z = -7.022^{***}$ ; OS:  $Z = -7.079^{***}$ ). Also, the children's participation (Child and Adolescent Scale of Participation) in neighborhood and community participation and participation in community living activities decreased ( $Z = -4.838^{***}$ ).

#### Chronic lung diseases (Cystic fibrosis, primary ciliary dyskinesia, and asthma)

A study from Belgium (Havermans et al., 2020) investigated how parents of children with cystic fibrosis (CF) were affected by the COVID-19 outbreak and observed several changes. Parents



reported increasing levels of stress (63.05%) and difficulty sleeping (31.5%). With 54.8% more than half cancelled child's hospital appointment. Other than that, changes in health relevant behaviors varied. With respect to home CF treatment, little change in oral medication of child with CF was reported: 49.3% skipped meals and 72.6% ate more, 28.8% adhered better to pills than before. Most children continued their treatment with home physiotherapist and nebulizing as before >67%, 32.9% did better physiotherapy than before, 30.6% did it at a different time. Regarding health protecting behavior and CF related worries, 35% reported to give the children more vitamins, 100% of children stayed always home. CF related worries did not increase a lot: only 22% were more worried when child cough, 21% worried more about CF. Finally, concerning the lung function, BMI, and change in treatment, parents' responses showed a significant change in nebulizing therapy: in comparison to the group of parents of children with higher lower lung function as indicated by FEV 1% pred (Forced expiratory volume in 1s) ( $M = 100.8\%$ ;  $SD = 15.9\%$ ), the parents of 11 children with lower FEV 1% pred ( $M = 85.5\%$ ;  $SD = 11.8\%$ ) reported that 'nebulizing has been forgotten', but also improved nebulizing and nebulizing at a different time ( $p < .01$ ).

A Turkish study compared sleeping habits between children with chronic lung diseases (cystic fibrosis and primary ciliary dyskinesia) and typically developing children. Data was collected via interviews and teleconference with the primary caregivers (115 mothers) between July 6<sup>th</sup>, 2020 and July 10<sup>th</sup>, 2020. The analysis shows that sleep breathing disorder scores were higher in children with PCD ( $p = .001$ ) while changes of the family's sleep patterns ( $p = .001$ ) and child's sleep patterns ( $p = .011$ ) and the time when the family ( $p = .002$ ) and child ( $p = .010$ ) went to bed changed significantly more in typically developing children (Eyuboglu et al., 2021).

The Italian study (Di Riso et al., 2021) investigated asthmatic children and an age and gender matched healthy control sample ( $Mean\ age = 10.67$ ;  $SD\ age = 2.29$ ). They investigated asthma control (see section on physical health) and children's and mothers' psychological functioning after the lockdown from May 28<sup>th</sup>, 2020 to August 23<sup>th</sup>, 2020. Most children reported scores at the non-clinical range for Strengths and Difficulties Questionnaire (SDQ (97.8%) and Separation Anxiety factor of the Spence Children Anxiety Scale (SCAS-SAD) (73.3%), and no differences were found in SDQ and SCAS-SAD scores between the asthmatic and control children's group. However, lower symptoms – as measured by the Global Initiative for Asthma (GINA) score – corresponded to better



asthma control, better self-perceived physical well-being of asthmatic children ( $r = .354, p = .025$ ), less “emotional symptoms” on the SDQ subscale ( $r = .299, p = .049$ ), and lower scores on the SCAS-separation anxiety factor ( $r = .306, p = .043$ ). Also, the Asthma Control Test was negatively correlated with the SCAS-separation anxiety factor ( $r = -.473, p = .001$ ). Mothers with asthmatic children reported higher fears for their children's contagion ( $p = .000$ ) and stronger concerns about the resumption of their children's activities ( $p = .000$ ). Furthermore, a multivariate regression model showed that a worsening of children's physical well-being and mothers' psychological well-being was associated with a worsening of asthmatic children's psychological well-being during the lockdown.

#### Special Educational Needs and Disability families

In a study from UK (Asbury et al., 2020), most of the Special Educational Needs and Disability families feel that the COVID-19 pandemic influences their own and their children's mental health such that it increases their experienced anxiety (44% vs. 25%) and stress (12% vs. 5%). "The level of worry many Special Educational Needs and Disability (SEND) families report appears to be substantial and serious." Similarly, "loss was also described by many participants as a result of COVID-19", SEND Families also experience a higher effect of these losses, because of the challenging needs of their children. Especially single parents experienced increased isolation from any support for their challenging child. Furthermore, for "children with SENDs it is not possible to explain why these losses have occurred, creating further difficulties." (Asbury et al., 2020).

#### LGBTQ+

LGBTQ+ young adults from the European countries Portugal, UK, Italy and Sweden reported less negative psychosocial effects of the pandemic than their counterparts from Brazil and Chile.

“Depression and anxiety were higher among participants who were younger, not working, living in Europe and who reported feeling more emotionally affected by the pandemic, uncomfortable at home, or isolated from non-LGBTQ friends. Not attending higher education predicted depression while not being totally confined at home, residing habitually with parents, and fearing more future infection predicted anxiety” (Gato et al., 2021).

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## What impact does the pandemic and the containment measure “school closures” have on children, adolescents, and young adults?

### Summary

In the literature screened so far, school closures seem to increase physical inactivity, screen time, as well as irregular sleep pattern, and less appropriate diets. Learning during lockdown was delayed and school children from less-educated families were disproportionately affected. However, given that this summary is based on only two studies, the results should be interpreted with caution.

In the literature screened so far, we did not find relevant publications on the following topics:  
None

**Number of publications: 3**

**Time period:** Jan 2020 – Sept 2021, single publications from [March- May 2021](#).

### Results

In a study in China, Wang et al (2020) observed that no school can increase physical inactivity, screen time, as well as irregular sleep pattern, and less appropriate diets.

The learning loss due to school closures has been examined by a longitudinal study in the Netherlands by Engzell et al. (2021) that used a dataset covering 15% of Dutch primary schools throughout the years 2017 - 2020 ( $N = 350'000$ ). They aimed to find out whether learning was delayed during lockdown and whether students from less-educated families were disproportionately affected. For that, they assessed standardized tests in the core subjects math, spelling and reading for 8- to 11-year-old students. The study found clear evidence that primary school students learned less during lockdown compared to a typical year - the losses were evident across the three subjects math, spelling and reading and throughout the studied age range. Even though the Netherlands had a relatively short lockdown (8 weeks), the study still found a learning loss of about 3 percentile points or 0.08 *SD*. Students from disadvantaged homes are disproportionately affected - losses were up to 60% larger among less-educated households compared to the general population (Engzell et al. 2021).

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Amor et al. (2021) explored access to information, emotional experiences, effects on living conditions and access to support during the lockdown in people with intellectual and developmental disabilities (IDD). 582 participants ( $M_{age} = 35.6$  years;  $SD = 14.1$ ; range = 3 to 83 years) reported that the pandemic and subsequent lockdown have had a deleterious effect on their emotional well-being (around 60.0% of participants) and occupations (48.0% of students and 72.7% of workers). Although access to information and support was reportedly good overall. Age [ $\chi^2(2, N = 582) = 12.9, p = .002$ ] and occupation [ $\chi^2(3, N = 582) = 13.7, p = .003$ ] were moderately ( $V = .15$ ) related to perceiving understanding the reason for the lockdown, with those under 21 years of age (25.0%) and those not working or studying (16.7%) reporting greater difficulty in understanding it. Those under 21 years of age more often reported difficulties to study remotely than did adults above 22 years (57.4% vs. 41.9%). Students who were unable to follow online education ( $n = 82, 48.0\%$ ) stated that they had difficulty with understanding teachers' explanations and tasks ( $n = 50, 61.0\%$ ), attention/concentration ( $n = 6, 7.3\%$ ) or interacting with the virtual environment ( $n = 6, 7.3\%$ ) or experienced a lack of support ( $n = 6, 7.3\%$ ). A high and significant proportion of those under the age of 21 years (36.9%) and students (30.4%) reported a lack of support. Seventy-three students (42.7%) claimed that they had not received support for online education, which was strongly related to age [ $\chi^2(2, N = 171) = 28.8, p < .001, V = .41$ ]. Individuals under the age of 21 years reported more support (79.4%) than did adults (38.7%). Educational support was mostly provided by relatives ( $n = 81, 82.7\%$ ), while little support was provided by organizations ( $n = 9, 9.4\%$ ) or school communities ( $n = 4, 4.8\%$ ). Being supported by a third party to complete the survey was consistently related to perceptions of worse outcomes.

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## What impact do the pandemic and the containment measures have on vulnerable children, adolescents, and young adults?

### Summary

Publications on children with specific vulnerabilities or living in vulnerable conditions are mostly discussed in the above sections based on the main outcomes investigated.

Regarding children's physical or mental health problems, studies addressed children with chronic diseases such as diabetes, chronic lung diseases such as cystic fibrosis or [asthma](#), cerebral palsy, congenital heart disease and children born very preterm, ADHD eating disorders, Autism Spectrum [Disorder or Developmental Disorder as well as children with cancer](#). Moreover, the effects of the COVID-19 measures on newborn infants and their mothers have been examined as well as on families with children with special educational needs and disability and LGBTQ+ young adults. These children and their families were differently affected by the COVID-19 measures such that decreases in the available health support burdened families whereas decreased obligations such as school or homework and more time for self-management were mentioned as facilitations.

Regarding contextual factors, initial studies indicate that families with low socio-economic background or a migration background were more negatively affected by the COVID-19 measures.

Finally, a UK study on keyworkers showed that containment measures seem to have increased their efforts, stress and workload during the lockdown as indicated by reductions in sleep.

**Number of publications: 19**

**Time period:** Jan 2020 – Sept 2021, single publications from [March - May 2021](#).

### Results

#### Families with social vulnerabilities

Among the vulnerable groups that were covered in the sections above were children with physical and mental health problems such as diabetes (Christofordis et al. 2020; Rabbone et al., 2020), chronic lung diseases (Di Riso et al., 2021; Eyuboglu et al., 2021; Havermans et al., 2020), congenital heart disease, very preterm-birth (Ehrler et al., 2021), cerebral palsy (Cankurtaran et al., 2021), ADHD (Bobo et al., 2020), eating disorders (Graell 2020), Autism Spectrum Disorder ([Berard](#)

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et al., 2021; Colizzi et al., 2020; Lugo-Marín et al., 2021; Meral, 2021; Mumbardó-Adam et al., 2021). In addition, there are also other vulnerability factors such as cancer (Güney et al., 2021), Special Educational Needs and Disability (SEND; Asbury et al., 2020) or LGBTQ+ (Gato et al., 2021).

In term of the role of contextual variables, results from a Spanish study on lifestyle behaviors showed that children from families with social vulnerabilities (for example mother with non-Spanish origin or a low educational level, low socioeconomic status) were more negatively affected by the COVID-19 confinement (Medrano et al., 2021).

#### COVID-19-relevant professionals / Key workers

Key workers from a cohort in the UK reported that they slept less since the national lockdown (OR 1.64, 95% CI; 1.11 to 2.38,  $p = .011$ ). However, overall, this specific cohort did not differ from the others (Topriceanu et al., 2021).

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