

Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults - 05.11.2021 - 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 abundance of data and different health endpoints investigated, we refer to the chapter abstracts for summaries.

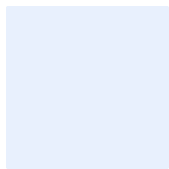


Content

Abstract/continuous reporting	1
Content	2
<i>Preamble</i>	2
Background	4
Questions addressed.	4
Methodology	5
Results and Findings	7
What impact do the pandemic and the containment measures have on everyday activities of children, adolescents, and young adults?	7
What impact do the pandemic and the containment measures have on physical health of children, adolescents, and young adults?	34
What impact do the pandemic and the containment measures have on mental health of children, adolescents, and young adults?	80
What impact does the pandemic and the containment measure “school closures” have on children, adolescents, and young adults?	164
What impact do the pandemic and the containment measures have on vulnerable children, adolescents, and young adults?	174
References	178

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.



List of statistical abbreviations

N (sample size) / n (subset of the sample)	sample size
p	p-value
r	correlation coefficient
M (e.g. $M_{age} = 11.4$)	mean
MD	mean difference
Mdn / Md	median
SD	standard deviation
SE	standard error
95% CI	confidence interval
X²/Chi²	chi square
OR	odd ratio
RR	risk ratio
IQR	interquartile range

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.

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?

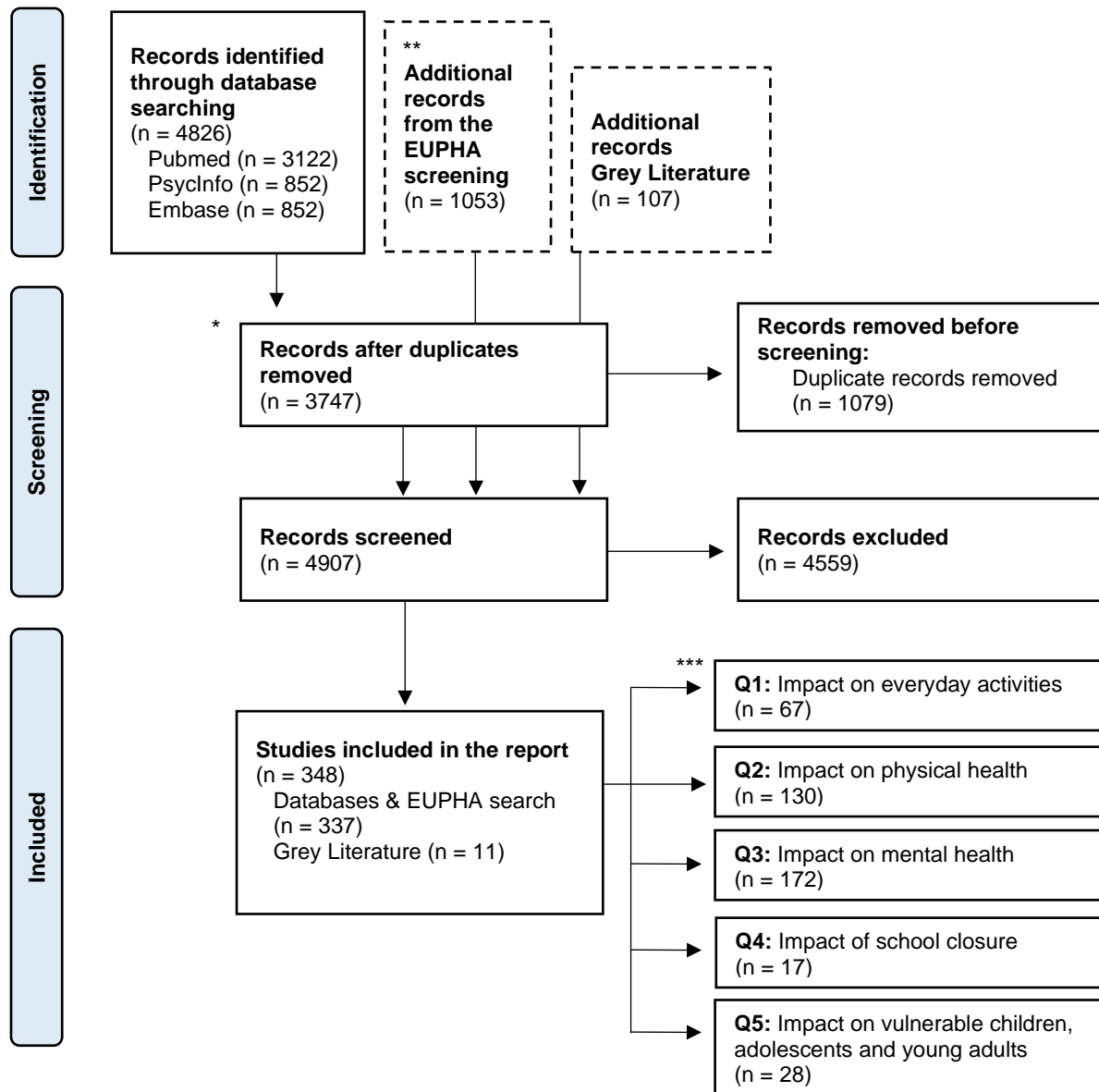
Methodology

The literature search spans the period January 1st, 2020 until the 31st of August 2021. Three literature data banks were accessed to identify relevant literature: PubMed (biomedical literature), Embase (biomedical), and PsychInfo (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 1st, 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 PsychInfo search was conducted weekly. Literature was exported into Rayyan (www.rayyan.qcri.org/), an open systematic literature search software, and screened for inclusion. Starting June 22th, 2021 we switched to Covidence (www.covidence.org). Screening was performed by one researcher; in case of questions a second opinion was requested. Inclusion criteria were 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 were excluded. Web of Science was searched monthly. Included publications were categorized and rated and relevant results extracted in a programmed Excel sheet by a researcher. Quality rating (yes, no, partly) was 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 were considered of sufficient quality.

Lastly, a search for grey literature, restricted to Switzerland, was 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 were approached for grey literature of interest they may have produced or know of. Data was be extracted from the management summaries and included in the overall narrative review.

Identification of studies on the topic “Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults”



* There can be a variance in numbers due to a change in the software used for the literature management.

** Numbers of articles already screened for title and abstract from the EUPHA project.

*** Some of the studies are listed in several topics.

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 based on longitudinal data. Most studies are cross-sectional, collect pre-covid data retrospectively and sample size is often small. *For younger children, but partly also up to 15 years of age many studies rely on proxy-reports from parents. Many cross-sectional studies used convenience or opportunistic samples and recruited via social media channels, via a snowball system.*

With these caveats in mind, current evidence on physical activity is inconsistent. Many of the cross-sectional studies point to a decrease in physical activity during confinement at home and during the lockdown in general, *both in healthy children and children with specific health concerns.*

Accordingly, studies report a decrease in the proportion of participants who met the physical activity. Most of these studies stem from countries with stringent measures over a long period of time. Some studies, also two German longitudinal studies, indicate an increase in physical activity, mostly related to more unstructured physical activity, and an increase in the adherence with WHO guidelines. The report includes articles covers the age range of interest (0 - 25 yrs.), and we found studies for all age groups. There seems to be a *differential impact* across child, adolescent and young adult age groups. *A few articles suggest that change in physical activity was least strong in children < age 5, respectively the gain was largest in the youngest.* Articles comparing young adults with older adults support the conclusion, that younger adults experienced a stronger decrease of physical activity, albeit the fact that physical activity is reported to be a coping method in young adults The data underlines the relevance of cultural or environmental differences, with higher impact on lifestyle in Latin American countries as compared to European countries.

Many studies investigated physical activity and screen time simultaneously, because firstly, screen time is mainly a sedentary activity and secondly, in times of lockdown screen time might have replaced physical activity. In both cases, the COVID-pandemic seems to have increased screen time in all ages, however, least in the youngest age group. Studies are consistent regarding male participants, males showing a higher increase in screen compared to female participants, and a positive trend with increasing age. Screen time is also addressed as an alternative pass-time (social media, tv), and there is evidence that recreational screen time increased. Girls seem to have

increased their social media time more than boys, while increase in gaming was associated with mal gender, most frequently.

They indicate an overall worsening of health behaviors and partly increasing nutritional inequality with lower socio-economic groups showing a worsening of nutritional behavior. For food consumption changes are reported by various studies but they vary in direction and health relevance. Some studies document change, but no significant pattern or classification of eating behavior. The increase in sweet foods during the lockdown found by some authors is inconsistent, more consistency is present for increase in fruit and vegetable consumption and reduction in convenience foods, and increase in home-cooking and sustainable foods. Some studies can refer to previous data and using established nutritional questionnaires. They indicate an overall worsening of health behaviors and partly increasing nutritional inequality with lower socio-economic groups showing a worsening of nutritional behavior. Parental behavior change is reported, with parents participating in more meals with their children, showing higher permissiveness with regard to eating rules and schedules. It is too early and too few studies have addressed how long-lasting the effect will be.

There is a rather large body of evidence pointing 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. Changes in sleep quality was reported, partly associated with stressors at home (e.g. financial concerns). Initial evidence points to negative impact on mental health of lower sleep duration during the pandemic.

Number of publications: 67

Results

Physical activity and screen time

The German Motorik-Modul study (MoMo) (Wunsch et al., 2021), a longitudinal study with a cohort sequence design, investigated the interrelation of physical activity, screen time and health-related quality of life in 1711 children and adolescents aged 4–17 years. Data was collected pre-COVID in MoMo wave 3 and during COVID pandemic, between April 20th and April 30th, 2020, using an online questionnaire. Descriptive data comparing Physical activity (PA), screen time (ST), and quality of life (HrQoL) pre- and during COVID indicate an increase in PA and ST, and a decrease in HrQoL in both girls and boys. PA within-COVID-19 was positively predicted by pre-COVID-19 HRQoL ($SE = 0.07$, $p = .003$) in the overall sample, however stratified only in girls ($SE = 0.09$, $p = .007$) and children 4–10 years old (standardized estimate = 0.08, $p = .022$). PA was negatively predicted by pre-COVID-19 ST ($SE = -0.21$, $p < .001$) in the overall sample. Stratified analyses indicate stronger impact in boys ($SE = -0.24$, $p < .001$) compared to girls ($SE = -0.18$, $p < .001$). ST was similarly associated with PA in both age groups.

The MoMo Study in Germany (Schmidt et al., 2020), a longitudinal study with a cohort sequence design, compared the physical activity (PA) and screen time (ST) of 1717 children and adolescents (aged 4–17 years) before and during the COVID-19 lockdown. Baseline data was collected from 2003 to 2006 and compared with data collected from April 20th and May 1st, 2021. The lockdown is associated with an increase in reported active days of 0.44 days per week ($p < .01$). There was an interaction between the lockdown and age group ($p < .01$): 4- to 5-year-olds increased their PA by 0.76 active days whereas 14- to 17-year-olds increased it by 0.26 days. Adherence to the WHO PA guidelines significantly increased by 11.1% in the overall sample (4- to 5-year-olds + 14.7%; 14- to 17-year-olds + 4.8%). At the same time, ST guideline adherence decreased by 17.5%. For the total amount of sport, the study found a significant decrease ($p < .01$) of 10.8 min per day. Again, an interaction between the lockdown and age ($p < .01$) was significant: 14- to 17-year-olds reduced their total amount of sports by 15.6 min per day whereas 4- to 5- year-olds reduced it by 2.2 min. Regarding the habitual physical activity the study found that an overall increase of 136.5 min per day, 4- to 5-year-olds accumulated more minutes of daily HA than 14- to 17-year-olds with 80.3 min. Boys accumulated more minutes of PA by playing outside, walking and cycling, and gardening, whereas girls accumulated more minutes of PA doing housework. In total recreational screen time increased by 61.2 min. per day: TV watching by 21.2 min, gaming by 21.5 min, recreational internet usage by 18.5 min. AN interaction was found between recreational ST and age ($p < .01$) This translates into a 17.5% overall decrease in adherence to the recreational ST guideline during the

lockdown and a substantially larger decrease for participants aged 14–17 years with – 18.4% compared to 4- to 5-year-olds with –4.1%. Interaction effects between the lockdown and sex were only found for gaming ($p < .01$).

Alonso-Martínez et al. (2021) examined change in physical activity, sedentary time, sleep and self-regulation in Spanish preschoolers aged 4–6 comparing longitudinally pre-lockdown data (Nov./ Dec. 2021) examined change in physical activity, sedentary time, sleep and self-regulation in Spanish preschoolers aged 4–6 comparing longitudinally pre-lockdown data (Nov./ Dec. 2019) from lockdown data (March – April 2020). Data on physical activity, sedentary time and sleep were collected with wrist-worn GENEActiv tri-axial accelerometer ($n = 21$), self-regulation using the child self-regulation and behavior questionnaire (CSBQ, $N = 157$). Preschoolers showed a decrease in total physical activity (adjusted $MD = -43.3$ min per day, 95% CI $[-68.1, -18.5]$) and in sleep efficiency ($MD = -2.09\%$, 95% CI $[-4.14, -0.04]$). Sedentary time increased ($MD = 50.2$ min per day, 95% CI $[17.1, 83.3]$).

López-Gil et al. (2021) assessed the changes in parental-reported physical activity, screen time and sleep duration during the COVID-19 lockdown in 1099 children and adolescents aged 3–17 years from Spain and Brazil (Spain $N = 604$, $M_{age} 12.1$, $SD = 4.6$ years). In Spain, data was collected via an online questionnaire distributed via social media for 15 days starting March 29th. The Spanish sample reported fewer days of engaging in 60 min. physical activity in the period of imposed isolation compared to “normally” (5.0 , $SE = 0.1$ vs. 4.3 , $SE = 0.1$; $MD = -0.7$; 95% CI $[-0.8, -0.5]$; $p < .001$), while screen time (6.5 , $SE = 0.1$ vs. 9.1 , $SE = 0.2$; $MD = -2.5$; 95% CI $[-2.6, -2.4]$; $p < .001$) and sleep duration (9.3 , $SE = 0.1$ vs. 9.8 , $SE = 0.1$; $MD = 0.5$; 95% CI $[0.4, 0.7]$; $p < .001$) increased compared to the pre-lockdown. The proportion of participants who met the physical activity and screen time guidelines decreased during the COVID-19 lockdown ($p < .001$).

In a cross-sectional study, Ozturk Eyimaya and Yalçin Irmak (2021) investigated the screen time of children aged between 6 and 13 years ($M_{age} = 9.03$, $SD = 1.95$) in Turkey. Data was collected between May 15th and May 31st, 2020 from 1115 parents of three randomly selected state schools through an online survey using a descriptive questionnaire form and the Parenting Practices Scale (PPS.) Most of the parents (71.7%) reported an increase in their children’s screen time, with the daily average being 6.42 ± 3.07 hours (min: 0; max: 15). A multiple regression analysis yielded the following significant predictor variables of increased screen time gender (being male) ($\beta = 0.067$, $p \leq .05$), child's age ($\beta = 0.249$, $p \leq .001$), low household income ($\beta = -0.104$, $p \leq .001$), mother's

employment status during COVID-19 mass-quarantine either shifted to a flexible work arrangement or usual workplace ($\beta = 0.101, p \leq .001$), no house rules regarding screen time ($\beta = -0.142, p \leq .001$) and inconsistent parenting practices ($\beta = -0.157, p \leq .001$).

A cross-sectional study from Ng et al. (2020) investigated how the physical activity (PA) levels changed in adolescents aged 12–18 years during the school closures in Ireland. A self-report online survey was carried out in April 2020 using 2 item scale (PA PACE+ instrument) to assess physical activities. Of the 1214 participants, almost half (49.7%) reported doing less PA during the lockdown period, while 19.1% reported doing more. Adolescents who were overweight ($OR = 1.8, 95\% CI [1.2, 2.7], p < .01$) or obese ($OR = 2.2, 95\% CI [1.2, 4.0], p = .02$) were more likely to report doing less PA than those who were normal weight. Reasons (open-ended question) for doing less PA were the COVID-19 restrictions or the cancelling of club training, reasons for doing more PA were more extra time because of school closures or staying healthy.

Gilic et al.'s (2020) tested 688 adolescents (15–18 years of age; 322 females) in Bosnia and Herzegovina on two occasions: in January 2020 (baseline, pre COVID-19 pandemic) and April 2020 (follow-up; during COVID-19 pandemic lockdown). A significant decline in physical activity level (PAL) was recorded between baseline and follow-up (t -test = 11.88, $p < .001$). Boys had higher PALs scores at both timepoints. Approximately 50% of adolescents reached sufficient PAL at baseline, while only 24% of them were achieving sufficient PAL at the time of follow-up measurement.

Zorcec et al. (2020) investigate the needs and challenges of families with children with chronic respiratory diseases in Macedonia. Data was collected between May and July 2020. Overall physical and mental health before and during the pandemic was reported by 72 parents. The proportion of children with a physical activity from more than 2 hour per day decreased significantly (52.8% – 20.8%, $p = .0006$). A statistically significant number of children showed a deterioration in mental health, shifting from feeling “excellent” 58.5% to 30.1%, $p = .00006$ to “well” (9.5% and 30.2%, $p = .0019$).

Pombo et al. (2020) launched a cross-sectional anonymous online survey to assess how Portuguese families with children aged younger than 13 years adjusted their daily routines with respect to the percentage of physical activity (%PA) to the COVID-19-confinement. In 2159 age 0 –

12 yrs. there was a trend for an increase of the overall sedentary time decrease of the overall physical activity time and an increase in screen time and family activities. Boys engaged in more playful screen time than girls ($p < .05$), and girls played more without PA than boys ($p < .05$). Children with an outdoor space and other children in the household were significantly more active ($p < .001$).

Orgilés et al. (2020) investigated the emotional impact of the quarantine on children and adolescents from Italy and Spain. Children spent significantly ($p < .001$) more time daily using screens such as iPads, TVs, mobiles, or computers; spent less time doing physical activity ($p < .001$); and tended to sleep more (mean hours) $p < .01$ in both countries.

Nyström et al. (2020) assessed in 100 preschoolers if they met the WHO guidelines for physical activity, sedentary behavior, and sleep in children aged 0–5 years and how movement behavior had been affected by the COVID-19 pandemic. During the pandemic Swedish children's physical activity, time spent outside on weekdays and weekend days, and screen time significantly increased (+53; +124; +68; +30min/day, respectively, all $p \leq .001$), possibly due preschools, playgrounds, organized sports and parks in Sweden remaining.

A cross-sectional Spanish online survey from López-Bueno et al. (2020) collected parental reported data between the 22nd March and 10th May 2020 on physical activity, screen time, vegetable and fruit consumption and sleep time on 860 children and adolescents. Overall, significant lower physical activity was compared to before pandemic times (-102.5 ($SD = 159.6$) min/week), with the highest reduction in 6-12-year-olds (-120.4 ($SD = 159.0$)). Screen time increased significantly for all participants (2.9 ($SD = 2.1$) h/day), highest in older participants (3.3 ($SD = 2.1$)). The results showed significant sleep time changes for the youngest (3–5) and oldest participants (13–16) with respectively -0.4 ($SD = 1.8$) and 0.6 ($SD = 1.7$), measured in h/day. Comparing survey time point of strict and relaxed confinement, relaxed confinement was associated with lower screen time (adjusted $OR = 0.60$ (95% CI [0.40,0.91])).

A French cross-sectional online survey (Genin et al., 2021) investigated change in physical activity levels (PAL), sedentary behaviors and screen time among children, adolescents and adults during the pandemic from 1st April to 6th May 2020. The questionnaire was based on items from the IPAQ (International Physical Activity Questionnaire) Youth Risk Behavior Surveillance System

investigation in children and adolescents. 1588 children and 4903 adolescents self-reported their behavior. Among children 42% decreased their PAL, 36.3% increased their sitting time and 62% increased their screen time, and among adolescents 58.7% decreased their PAL, 24.1% increased their sitting time and 69% increased their screen time. In both age groups positive developments were observed: increased PAL (children 36.7%, adolescents 19.5%) decrease in sitting time (children 29.7%, adolescents 16%) and screen time (children 1.4%, adolescents 3.2%)

A Spanish cross-sectional study from Cartanyã-Hueso et. al. (2021) took place from April to June 2020 and investigated screen time in 313 children living in Barcelona aged <48 months. 67.5% of children under 48 months were exposed daily, ranging from 38.5 – 87.9% with increasing age. In this sample the association with parental education was non-significant and 77.7% the 12 to 17 months old children were exposed to smartphones and tablets, slightly lower than in the 2017 National Health Survey (NHS, 82.3%), possibly due to overrepresentation of highly educated parents.

Cachón-Zagalaz et al. (2021) describe physical activity (PA) and daily routines (artistic work, school and domestic chores, free and family play, music or reading.) among children in Spain (convenience-sample, $N = 837$, age range 0 – 12 years, 44,8% ≥ 6). Girls slept more hours a day ($M = 10.04$; $SD = 1.53$) and spent more time on daily activities ($M = 428.22$; $SD = 185.24$), boys spent more time in front of digital screens ($M = 163.29$; $SD = 125.27$) compared to the opposite gender. No differences in PA were seen by gender. Families that did establish routines and schedules for performing tasks were associated with more time spent practicing daily PA ($M = 38.13$; $SD = 35.01$). However, those who did not establish them showed a greater number of hours sleeping ($M = 10.32$; $SD = 1.64$) and in front of digital screens ($M = 186$; $SD = 135.20$).

A cross-sectional transnational online survey (Francisco et al., 2020) analyzed the psychological and behavioral symptoms associated with COVID-19 quarantine in children and adolescents. Data was collected from 1480 parents of children between 3–18 years ($M = 9.15$, $SD = 4.27$) from Portugal, Spain and Italy during 15 days between March and April 2020. Regarding the use of screens, daily physical activity (PA), and hours of sleep (before and during quarantine), the analysis showed significant difference in effect sizes across countries. In the overall sample there was an increase in the daily use of screens during quarantine ($p < .001$), with the proportion of children with >180 min/day usage increasing from 3.5% to 30.1%. The mean number of hours of sleep increased significantly during weekdays during home confinement There was a

significant decrease in PA ($p < .001$) and the proportion of children <30 min. of PA/day. increased from 12.8 to 53%. Not having an outdoor exit at home was significantly correlated with sleep ($p < .001$).

A Portuguese study from Branquinho et. al. (2020) is a qualitative study about young people's experience of the covid19 pandemic. 617 adolescents aged 16 to 24 years completed an online survey between 14th April and 18th May 2020. For the domain "daily life and routines", starting exercising was mentioned, while interference with sports practice and athletes lives was a negative effect raised.

A total of 89 Spanish adolescents, 12 and 14 years old ($SD = 0.9$) and 49.4% girls, participated in a longitudinal study of López-Bueno et al. (2021) on cardiorespiratory fitness before and after the COVID-19 confinement. Particularly boys aged 12 and girls aged 14 years showed important reductions of maximum oxygen intake (VO_2) in relation to what is expected for their age. Average VO_2 max before COVID-19 confinement was $46.2 \text{ ml.kg}^{-1} \cdot \text{min}^{-1}$ ($SD = 0.6$), whereas the average VO_2 max after COVID-19 confinement was $45.7 \text{ ml.kg}^{-1} \cdot \text{min}^{-1}$ ($SD = 0.7$), with an estimated difference of $-0.5 \text{ ml.kg}^{-1} \cdot \text{min}^{-1}$ ($SD = 0.3$, $p = .12$) between November 2019 and November 2020. Subgroup analyses estimated a significant VO_2 max reduction for the subgroup of girls ($-1.0 \text{ ml.kg}^{-1} \cdot \text{min}^{-1}$ ($SD = 0.4$, $p < .05$), particularly girls aged 14 years ($-1.5 \text{ ml.kg}^{-1} \cdot \text{min}^{-1}$ ($SD = 0.6$)), and an improvement in boys aged 14 years ($+0.4 \text{ ml.kg}^{-1} \cdot \text{min}^{-1}$ ($SD = 0.5$, $p = .44$)). Overall, the prevalence of children defined as fit based on norm values of the Healthy Fitness Zone (HFZ, Cooper Institute, TX, USA) before and after COVID-19 confinement was 79.8% respectively 76.4%. The highest reduction of HFZ was observed for girls aged 14 years (-15.4% , $p = .10$), and second (-6.6% , $p = .16$) and third tertiles (-9.9% , $p = .08$) of BMI subgroups.

Theis et al. (2021) cross-sectional study aimed to assess how COVID-19 affected physical activity and mental health of children and young adults with physical and/or intellectual disabilities. Between June 17th and July 17th, 2020, parents or carers completed an electronic survey with adapted validated instruments (International Physical Activity Questionnaire Short Form; IPAQ-SF), Strength and Difficulties Questionnaire¹⁸ and other COVID-19 surveys, such as "Coronavirus: Impact on young people with mental health needs", youngminds.org). Data of 125 children with a mean age of 12.3 years ($SD = 4.3$) was collected. The majority (61%) of the parents reported a decrease in physical activity levels in the last 7 days and a comparison between expected and observed values was significantly different ($\chi^2 = 33.433$, $p < .001$).

The Italian longitudinal study from Maltoni et al. (2021) in an outpatient population of obese children ($N = 51$, $M_{\text{age}} 14.7$ ($SD = 2.1$ years)) investigated the impact of the lockdown on the BMI changes and change in physical activity (PA) and sedentary behavior (SB). Data were collected during 2 months before March 8th and between May 18th till the end of June 2020. The hours of mild PA were reduced ($+2.9 \pm 2.8$ h/day; $p < .001$) and the hours dedicated to SB were decreased (-1.0 ± 1.6 h/week; $p < .001$)

Pombo et al. (2021) conducted a cross-sectional study in Portugal investigating potential effects of home confinement on children's physical activity (PA) and sedentary time. Parents or adults of a total of 2159 children below 13 years completed an online survey between March 23th and April 1st, 2020. The time of children's physical activity decreased, but family activities, screen time and sleep duration increased during home confinement compared to previous school time. There was a significant positive association between intellectual activity and age ($p < .001$), as well as between playful screen time and age ($p < .001$). Male participants between 6 and 12 years spent significant more time with playful screen time than girls ($p < .001$). There was a significant negative association between play without physical activity and age ($p < .001$), decreasing with age after age 3–5 years, and female sex ($p < .001$). Overall physical activity and sedentary time was only associated with age ($p < .001$).

A cross-sectional study from Czech Republic (Štveráková et al., 2021) examined the impact of COVID-19 on physical activity of children, 8–12 years, measured with the Physical Activity Questionnaire for Older Czech Children (PAQ-C/cz) ($N = 98$) for which Pre-COVID data was available (Cuberek et al., 2019¹, $N = 206$). Further the number of daily steps was collected in 35 children. Significant differences in physical activity between pre-COVID and COVID lockdown mean scores were noted for: Spare time, before school, physical education, and recesses. No significant differences were noted for: after school, evening, weekend or weekly activity. No gender or age differences were observed.

A high prevalence of physical inactivity among adolescents (10–19 years), before and during lockdown, was reported by Ruiz-Roso et al. (Ruíz-Roso et al., 2020): 79.5% during the confinement

¹ Cuberek R, Janíková M, Dygrýn J. Adaptation and validation of the Physical Activity Questionnaire for Older Children (PAQ-C) among Czech children. PLoS one. 2021; 16: e0245256. <https://doi.org/10.1371/journal.pone.0245256>

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 ± 55 min/day, $p < .001$) during the confinement while at the same time the screen time increased (1.9 ± 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 ± 0.3 hours/day vs. 1.3 ± 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 ($p < .001$).

The longitudinal study from Italy (Serra et al., 2021) examined smartphone use and smart phone addiction (measured by SAS-SV) during the Corona pandemic in a total of 184 children and adolescents, aged 6–18 years. Data was collected in December 2020 and January 2021 during the second wave of the COVID-19 pandemic. The data yield a change in use regarding duration (66.3% vs. 16.3% spent more than 4 hours on their smartphone) and use patterns and reasons for use. Before COVID-19 31.5% were found at high risk of addiction as compared to 27.2% during the pandemic.

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 the coping method was “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 18th to June 30th, 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. 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.

Chen, Osika et al. (2021) measured the impact of COVID-19 on 15-year-old adolescents (baseline age 13.6 ± 0.4 years) in Swedish cohort. They compared 1316 youth who were reexamined in January 2021, not exposed, with 584 youth reexamined after February 2021, exposed to the COVID-19 pandemic. In the COVID exposed group, girls compared to boys significantly decreased their physical activity (60 min/days a week, $p = .025$) and belief in future ($p = .041$).

A study in the UK birth cohorts provides data on physical activity, alcohol consumption, sleep duration, and food habits during the lockdown compared to pre-lockdown data (Bann et al., 2021). The MCS cohort, born in 2001, showed a tendency to reduced physical activity, alcohol consumption frequency, increase in fruit and vegetable consumption, and sleep duration. While in older cohorts an increase in socio-economic inequality was seen for all outcomes of interest, in the MCS cohort it was only present for fruit and vegetables consumption.

Kaya Kara et al. (2021) evaluated the participation, support and barriers for 55 children with ADHD aged 6 to 11 years ($M_{age} = 8.6$; $SD = 1.6$; 85.5% boys) at home before and during the COVID-19 outbreak in Turkey using the Participation and Environment Measure for Children and Youth (PEM-CY). Mothers reported that their children participated significantly more frequently in some of the home activities during the pandemic compared to the pre-pandemic period: participation in computer and video games, socializing with other people, household chores. Furthermore, they

reported higher levels of involvement during the pandemic compared with the pre-pandemic period across four areas,” including computer and video games, arts, crafts, music and hobbies household chores and personal care management²

Nutrition and eating behavior

This cross-sectional study (Parnham et al., 2020) in the United Kingdom collected questionnaire data between the 17th and 30th April 2020 and investigated if eligible children and adolescents had access to free school meals (FSM) during the covid19 lockdown or the voucher introduced during the pandemic . Half the children (49%) eligible for FSM did not receive any form of FSM during the lockdown. Children in the lowest income category were almost five times more likely to receive their FSM entitlement than high income children ($aOR = 4.81$, 95% CI [2.10, 11.03]). Attending school was associated with six times higher odds to receive their FSM entitlement than children not attending schools ($aOR = 5.87$, 95% CI [1.70, 20.25]). Children in Wales, compared with England, were less likely to access an FSM ($aOR = 0.11$, 95% CI [0.03, 0.43]). And lastly, children in junior and secondary schools were more likely to access FSMs than younger children (infant schools, $aOR = 11.81$ and 16.45, respectively).

A cross-sectional Spanish study from López-Bueno et al. (2020) ran an online survey between March 22nd and May 10th, 2020 about the physical activity, screen time, vegetable and fruit consumption and sleep time of 860 children and adolescents during the covid-19 pandemic. Consumption of fruit and vegetable was significantly reduced for all participants but the older ones. 3–5-year-olds reported -0.6 ($SD = 2.0$) and 12-year-olds -0.2 ($SD = 1.5$) portion/day.

A cross-sectional Polish study (Głabska et al., 2020) investigated in 2448 secondary school students ($M_{age} = 16.8$, $SD = 1.1$) food choice determinants adolescents. They completed the Food Choice Questionnaire (FCQ) developed by Steptoe et al. between April and May 2020. 63.4% of the students were female. Both before and during the pandemic sensory appeal and price were the most important factors for food choice. Health ($p < .0001$) and weight control ($p < .0001$) factors was more important during the pandemic than before the pandemic whereas mood ($p = .0002$) and sensory appeal ($p < .0001$) were less important than before the pandemic.

² Operationalisation of “participation” and “involvement” based on a Likert-type response option is missing. No detailed results are presented therefore

A cross-sectional Turkish study from Oge Enver et. al. (2021) investigated if patients with chronic diseases such as inherited metabolic disorder had difficulties in accessing health care during the covid-19 pandemic. An online survey was completed between May 1st and May 30th, 2020 by 175 patients ($M_{age} = 87$ months). The results shows that the vast majority of the patients (63%) had a special diet and most of them did not have any problems following it (47.7%), whereas 31% of patients did have sometimes problems and 21% of patients did have had issues with their diet. 74% of the patients who were applying a diet did not have a problem about reaching their special formulas and low -protein dietary products. 38% of the patients used a special treatment and 91% of them had no problems receiving their special treatment during.

5811 parents of children <18 years old participated in a cross-sectional Italian study on food insecurity (Dondi et al., 2020), 6 months after outbreak of the COVID-19 pandemic between September 1st and October 15th, 2020, online survey data . Food insecurity refers to “a lack of access by all people at all times to enough food for an active and healthy life”. 89% of the participants were from northern Italy. Before the pandemic 8.4% reported a risk of food insecurity in their family, increasing to 16.5% during the pandemic. Multivariate analyses yielded families from Southern Italy, with a household difficult or unsustainable economic situation, more than one child or at least one parent on furlough to be at a significantly higher risk of becoming food insecure, while parents’ over 50 years, higher parents’ school grade, and both parents being employed appeared to be protective factors. Almost a third (27.5%) of parents reported that their child was eating more and this was more frequent in families at risk of food insecurity. Furthermore, it was reported that the consumption of snacks, sugared fruit juices, and soft drinks increased. Factors associated with increased children’s food intake were parental female sex, difficult or unsustainable household economy, more than one child, children older than 2, and children missing outdoor activities. Children older than 14 years were significantly at a higher risk of weight loss. Weight gain was not significantly higher in children from families at high risk of food insecurity.

In a cross-sectional study, Huber et al. (2021) enrolled 1964 voluntary participants from Bavarian universities ($M_{age} = 23.3 \pm 4.0$ years). All participants were asked to complete an online questionnaire, semi-quantitatively evaluating the amount and type of food before and during pandemic lockdown. The overall food amount increased in 31.2% of participants ($n = 610$) during lockdown and decreased in 16.8% ($n = 328$). A multinomial regression model revealed lower odds of food increase in male participants ($OR = 0.73$, 95% CI [0.57, 0.94]) and a higher odds with increasing BMI ($OR = 1.43$, 95 % CI [1.032, 1.97]), reduced sports activity ($OR = 1.34$ 95% CI [1.02,

1.76]), augmented mental stress ($OR = 1.36$, 95% CI [1.08 1.71]), and an alteration of alcohol consumption (reduced alcohol amount, $OR = 1.34$, 95% CI [1.07, 1.76], increased alcohol, $OR = 1.86$, 95% CI [1.36, 2.54]).

In a convenience sample of $N = 211$ adults Büyüksoy et al. (2021) investigates food insecurity and the consumption frequency of some nutrients in families with children living in Turkey he study revealed that 21.8% households reported food insecurity that was not at the hunger threshold, 11% with moderate and 8% with severe hunger. In the last six months 80.6% reported a monthly household income below the poverty line, the monthly income having decreased in more than half of the households during the pandemic. A multivariate analysis including economic covariates and the outcome food insecurity the risk of food insecurity increased 2.5 times workers or self-employed compared to other professions ($p < .01$), increased 3.1 times in households experiencing a decrease in their monthly income ($p < .001$), and increased 2.0 times when total monthly household income fell below poverty line ($p < .05$).

A study from the UK (Marino et al., 2021) explored the impact of the national lockdown from March to early summer 2020 on nutritional status of 116 children with inflammatory bowel disease, M_{age} 13.3 years ($SD = 2.9$ years), based on anthropometric measurements collected at Southamptons Children's hospital prior (time point 1) and following (time point 2) the national lockdown. The children with initial malnutrition experienced a significant further decline in their nutritional status, change in normal and overweight children was non-significant. 19% of children had mild malnutrition with a mean BMIZ of -1.3 ± 0.9 at time point 1 compared to a mean BMIZ of -1.9 ± 0.9 at time point 2, as well as a statistically significant mean delta change in BMIZ of -0.6 ± 1.5 ($p = .03$). 44% of children in the cohort had a normal BMIZ with a mean score of 0.1 ± 0.6 at time point 1 compared to a mean BMIZ of 0.2 ± 0.6 at time point 2, with a mean delta change in BMIZ of 0.1 ± 0.6 ($p = .5$). Children who were overweight made up 37% of the cohort and had a mean BMIZ score of 1.2 ± 1.2 at time point 1 compared to a mean BMIZ of 1.6 ± 1.4 at time point 2, with a mean delta change in BMIZ of 0.04 ± 0.2 ($p = .5$).

Skolmowska et al. (2021) investigated differences in the scores of the Adolescents' Food Habits Checklist (AFHC) in the Polish Adolescents' COVID-19 Experience Study (PLACE-19) conducted in May 2020 (first stage: April 9th to May 10th, and second stage: May 11th to 23th). The AFHC contains questions concerning food purchasing and preparing, and consuming certain types of food, both healthy and unhealthy, questions were asked for pre-COVID (before remote-learning) and in-

COVID (during remote-learning). In the population-based sample of $N = 2448$ students between 15 and 20 years old most items relating to food purchase dietary habits were statistically significantly different comparing pre to in-COVID AFHC. Even though the mean values of the questionnaire dimensions and items changed, classifications did not.

The DESKcohort project, which monitors 12- to 18-year-old students that attend educational centers in Central Catalonia (Aguilar-Martínez et al., 2021) analyzed the eating behavior before the COVID pandemic and at the end of the confinement in Spain. A total of 303 students ($M_{age} = 16.4$ years) completed DESK cohort questionnaire between October 2019 and February 2020 and the DESK-COVID survey between June and July 2020. During the COVID-19 participants (38.9%) reported a decrease of sweets and pastries (39.3%), convenience food (49.2%), and soft drinks (49.8%) and an increase in the consumption of fruit (38.9%). Students who perceived a more disadvantaged socioeconomic position were more likely to reduce the consumption of cereals ($PR = 1.03$; 95% CI [1.00, 1.05]; $p < .03$), and fruit ($PR = 1.02$; 95% CI [1.01, 1.04]; $p < .01$) and significant more likely to increase the consumption of convenience food ($PR = 1.04$; 95% CI [1.01, 1.06]; $p < .01$).

Additionally, a more disadvantaged perceived socioeconomic position was related to a significant higher reduction regarding regularity of meal hours ($PR = 1.01$; 95% CI [1.00, 1.02]; $p < .01$) and an increase in skipping meals ($PR = 1.02$; 95% CI [1.00, 1.03]; $p < .02$). Comparing tertiles of socioeconomic position, the lowest, most disadvantaged tertile had an increased risk of 21% ($PR = 1.21$; 95% CI [1.10, 1.34]) compared to the intermediate and advantaged tertiles.

The COV-EAT study was a cross-sectional study, which was conducted across 63 municipalities in Greece (Androutsos et al., 2021). Parents reported changes in children's and adolescents' lifestyle habits and body weight during the first COVID-19 lockdown. Children's/adolescents' sleep duration and screen time increased, while their physical activity decreased. Their consumption of fruits and fresh fruit juices, vegetables, dairy products, pasta, sweets, total snacks, and breakfast increased, while fast-food consumption decreased. Body weight increased in 35%. Increase in bodyweight proved to be significantly associated with increased consumption of breakfast, salty snacks, total snacks, and decrease of physical activity.

Ruiz-Roso et al (2020) 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 ± 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, Smith, 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 25th to May 13th 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. (2021) 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 pre-pandemic 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).

The study on UK birth cohorts also provides data on alcohol consumption and food habits during the lockdown as compared to pre-lockdown data. The MCS cohort, born in 2001, showed a

tendency to reduced alcohol consumption frequency and increase in fruit and vegetable consumption. With respect to socio-economic inequality an increase of inequality was present for fruit and vegetable consumption in the MCS cohort. (Bann et al., 2021).

A French study in 498 parents with children aged 3–12 years asked about nutritional behavior during the lockdown, and retrospectively before the lockdown. Parents reported taking more meals together with their children ranging from 14% parents eating more breakfast to 59% parents eating more lunches together. 60% reported a significant change in all investigated dimension of their child's eating behaviors, with exception of food pickiness. Largest increase in mean scores was observed for emotional eating and food responsiveness. 36% parents reported an increase in snack frequency in between meals and 4% a decrease. Compared to snacks before the lockdown the following snacks increased significantly: candy/chocolate, fruit juices, sodas, chips/salty biscuits, ice creams, pastries/cake/sweet cookies, cream dessert, milks, yoghurt/cheese/quark, fresh and dried fruits, and nuts. Simple regression analyses yielded that boredom was a significant predictor of emotional overeating, in food responsiveness and in snack frequency in between meals. When parents changed their practices, they generally became more permissive (less rules, soothing with food, less strict time schedules). They bought pleasurable and sustainable foods more frequently, prepared more home-cooked meals and cooked more with the child. (Philippe et al., 2021)

The study from Akgül et al. (2021) in 64 adolescent patients with eating disorders followed during the past year at the Division of Adolescent Medicine and the Department of Child and Adolescent Psychiatry investigated eating behavior during the age-stratified lockdown for those under 20 years in Turkey. 38 participants completed a survey on eating disorder behaviors, well-being and quality of life (QoL), including the eating disorder examination questionnaire (EDE-Q), scales for depression, anxiety and obsessive-compulsive behavior. The study, contrarily to previous literature, has shown almost half of the participants felt an improvement in their eating disorder and a majority reported rare conflict with parents.

Sleep (and screen time)

Esposito et al. (2020) conducted a cross-sectional study in Italy analyzing the psychological impact and changes in lifestyle due to school closures during the COVID-19 lockdown. 2064 adolescent students aged 11-19 years (62.8% females; M_{age} , 15.4, $SD = 2.1$ years) completed an online survey between April 8th and April 21st, 2020. School closure was associated with the development of psychological problems and significant changes in lifestyle: 46.8% of the male participant reported

sleeping more since the school closures, while 43.1% of the females stated sleeping less than before ($p < .001$), especially the younger students aged 11–13 years were more likely than the older students aged 14–19 years to report sleeping more than before the schools had been closed ($p < .001$).

López-Gil et al. (2021) assessed the changes in parental-reported physical activity, screen time and sleep duration during the COVID-19 lockdown in 1099 children and adolescents aged 3–17 years from Spain and Brazil (Spain $N = 604$, $M_{age} 12.1$, $SD = 4.6$ years). In Spain, data was collected via an online questionnaire distributed via social media for 15 days starting March 29th. The Spanish sample reported sleep duration (9.3, $SE = 0.1$ vs. 9.8, $SE = 0.1$; $MD = 0.5$; 95% CI [0.4, 0.7]; $p < .001$) increased compared to the pre-lockdown.

Alonso-Martínez et al. (2021) examined change in physical activity, sedentary time, sleep and self-regulation in Spanish preschoolers aged 4-6 comparing pre-lockdown data (Nov./ Dec. 2019) from lockdown data (March – April 2020). Data on physical activity, sedentary time and sleep were collected with wrist-worn GENEActiv tri-axial accelerometer ($n = 21$). Preschoolers showed a decrease in sleep efficiency ($MD = -2.09\%$, 95% CI [-4.14, -0.04]).

A cross-sectional Spanish online survey from López-Bueno et al. (2020) collected parental reported data between the 22nd March and 10th May 2020 on physical activity, screen time, vegetable and fruit consumption and sleep time on 860 children and adolescents. The study yielded significant sleep time changes for the youngest (3-5) and oldest participants (13-16) with respectively -0.4 ($SD 1.8$) and 0.6 ($SD 1.7$), measured in h/day.

A cross-sectional study from Di Giorgio et al. (2021) investigated how the restrictive measures impacted mothers and their pre-school children's behavioral habits (sleep quality and subjective time experience) and psychological well-being (emotion regulation and self-regulation capacity). 245 mothers with children between 2 and 5 years were recruited via online ads and social media. All outcomes were collected for the period 1st and 9th April 2020, during the quarantine, and retrospectively for before the national lockdown. Children went to bed on average 53 min later ($F(1,241) = 259.0$, $p < .0001$, $n_2p = .52$) and woke up 66 min later ($F(1,241) = 260.35$, $p < .0001$, $n_2p = .52$). The proportion of children with some sleep difficulties (i.e., $SDSC > 39$) was stable, from 41.46% before the lockdown to 44.72% during the lockdown ($p = .399$; $OR 1.23$).

A cross-sectional Italian study from Cellini et. al. (2020) took place between 7th May and 15th June 2020 (home confinement and school closure) and evaluated changes in sleep patterns and disturbances during covid19 outbreak in children and adolescents ($N = 4314$). The participants completed an online survey following the guidelines of the Checklist for Reporting Results of Internet E-Surveys. The study indicates a significant delay in bedtime and risetime in all age groups. School-age children and adolescents experienced the most significant delay. Risetime was delayed with most children waking up after 8 in all age groups. Consequently, sleep duration increased in all but the younger group. Overall, parents reported an increased prevalence of sleep disorders during the lockdown, mainly represented by difficulty falling asleep that changed in all age groups (from 16.8% to 29.5% in 1- to 3-year-old children, from 13.3% to 25.9% in the 4- to 5-year-old group, from 11.6% to 26.5% in 6- to 12-year-old subjects and from 12.3% to 21.9% in the 13- to 18-year-old group). Anxiety at bedtime increased in the first three groups (from 4.7% to 12.7%, from 7.4% to 19.1%, and from 7.0% to 15.2%, respectively) and night awakenings increased from 19.7% to 26.2%, from 7.1% to 12.9%, and from 3.5% to 7.5%, respectively. Increasing nightmares was reported in the first three groups (from 1.8% to 4.4%, from 8.5% to 20.5%, and from 7.1% to 16.1%, respectively) and sleep terrors in the first two (from 3.4% to 6.7% in 1- to 3-year-old children, and from 2.1% to 4.5% in the 4- to 5-year-old group). Lastly, daytime sleepiness was affected resulting in "1.5% vs. 4.2% in 1- to 3-year-old children, 1.9% vs. 5.9% in the 4- to 5-year-old group, and 4.7% vs. 10.1% in 6- to 12-year-old subjects". Adolescent overall had the less impacts compared with the other age groups with the main difficulty to falling asleep. Interestingly bruxism showed an inverted trend and decreased from 11.3% to 8.7% in the 6- to 12-year-old group. As a positive aspect about the changes due to pandemic is discussed to be a more physiological sleep-wake schedule

A further study by Cellini et al. (2021) investigated experiences regarding sleep and time perception during the quarantine (from April 1th to 9th, after 3 weeks of confinement), and retrospectively in the week before the total lockdown (February 24th–29th) in a convenience sample recruited via a snowballing system ($N = 299$ mothers, children $M_{age} 7.96$, $SD = 1.36$). In general, children went to bed 1 hr and 18 min later ($p < .001$) and woke up 1 hr and 50 min later ($p < .001$) during the lockdown than before. There was a significant interaction between Work and Lockdown ($p < .017$), with children whose mothers started working from home or had to stop working spent more time in bed (p 's $< .001$). The proportion of children with potentially disturbed sleep (i.e., SDSC > 39) did not increase significantly during home confinement ($p < .541$).

Cachón-Zagalaz et al. (2021) describe physical activity (PA) and daily routines (artistic work, school

and domestic chores, free and family play, music or reading.) among children in Spain (convenience-sample, $N = 837$, age range 0 - 12 years, 44,8% ≥ 6). Girls slept more hours a day ($M = 10.04$; $SD = 1.53$) and spent more time on daily activities ($M = 428.22$; $SD = 185.24$), boys spent more time in front of digital screens ($M = 163.29$; $SD = 125.27$) compared to the opposite gender. Establishing routines and schedules was not associated with a greater number of hours sleep ($M = 10.32$; $SD = 1.64$).

A cross-sectional transnational online survey (Francisco et al., 2020) analyzed the psychological and behavioral symptoms associated with COVID-19 quarantine in children and adolescents. Data was collected from 1480 parents of children between 3 - 18 years ($M_{age} = 9.15$, $SD = 4.27$) from Portugal, Spain and Italy during 15 days between March and April 2020. Regarding hours of sleep (before and during quarantine), the analysis showed significant difference in effect sizes across the countries. The mean number of hours of sleep increased significantly during weekdays during home confinement for the total sample. Not having an outdoor exit at home was significantly correlated with sleep ($p < .001$).

This Turkish study from 2021 (Bucak et al., 2021) investigated the different sleep habits between children of health workers (group 1 $n = 122$) in a tertiary hospital and non-health workers (group 2 $n = 250$) who had had an appointment for their child in the previous year. In total they found greater impairment of sleep habits of school age children of health workers compared to those of non-health workers in the COVID-19 pandemic: Children's Sleep Habits Questionnaire scores were 41.57 ± 7.57 (20 - 60) in Group 1 and 39.6 ± 8.47 (17 - 68) in Group 2 ($p = .03$). The study did not provide multi-variate analyses.

Markovic et al. (2021) investigated effects of COVID-19 on children's sleep using the Brief Infant Sleep Questionnaire and Children's Sleep Habits Questionnaire depending on age of the child. Parents were recruited via social media, childcare institutions and medical practices. Data on 452 babies (0–35 months) and 412 preschool children (36–71 months) from different countries were collected in April 2020 (t1), May (t2) and June 2020 (t3), and pre-covid data was collected retrospectively. Parents, who expressed no confinement impact on their working or child care arrangements were excluded. The sleep quality decreased in both age groups of children during compared to pre-confinement. Babies were put to bed later (delay by 21 ± 42 min), slept less (by 6 ± 53 min) and their sleep latency prolonged (by 8 ± 21 min) during the confinement in comparison to the time before. Preschool children went less regular to bed (by 0.40 ± 0.85 points), fell less

frequently asleep within 20 min (by 0.31 ± 0.87 points), experienced an increase in day-to-day variability of sleep duration (by 0.16 ± 0.69 points) and in sleep fragmentation (by 0.13 ± 0.72 points). Caregiver's stress due to the confinement was identified as the dominant negative determinant of children's sleep, while performing mindfulness strategies or siblings (only children) were significant protective factors, as well as care-activities and pets. The follow ups showed that the effect regarding sleep quality largely disappeared. Caregivers reported a decrease of stress (2.82 ± 1.10 points in May and 2.72 ± 1.15 points in June). The protective factor "mindfulness strategies" remained for preschool children in all 4 variables and the number of awakenings of babies ($p < .001$). Siblings still had no effect of babies but the frequency of going to bed at the same time ($p < .001$) and the frequency of sleeping the same duration ($p = .023$) of preschool children. More protective factors conserving children's sleep quality included child-care activity (for babies only) and age (for both).

Bacaro et al. (2021) focused on the impact of COVID-19 on sleeping habits of small children between 0 to 12 years. Parents of 2361 children ($M_{\text{age}} = 8.1$; $SD = 2.62$) filled out an online survey which covered sleep and insomnia. 1) Sleep: When it comes to bedtime most children in all age ranges went to bed after 9 p.m. (45.7%), or after 10 p.m. (45.9%). Regarding sleep hygiene habits, most children in all age ranges had regular sleep times during home confinement (81.7%), pre-bed routines every night (70%), and did not use the bed actively during the day (55.1%) and in the evening (68%). 2) insomnia: 59.4% showed at least one diagnostic clinical criterium of insomnia. There was a sig. association between age and insomnia ($OR = 0.88$, 95% CI [0.84, 0.92], $p < .001$), younger age associated with more childhood insomnia. "One-child family" was associated with a higher prevalence of childhood insomnia compared to "larger families" ($OR = 1.34$, 95% CI [1.07, 1.68], $p < .011$). Current parental insomnia ($OR = 1.45$, 95% CI [0.90, 1.50], $p < .001$) and the presence of any other sleep problem ($OR = 3.20$ 95% CI [2.62, 3.90], $p < .001$) compared to their absence were significantly associated to the presence of childhood insomnia.

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 ± 1.1 hours/day, $p < .001$) and on weekend days (0.7 ± 1.6 hours/day, $p < .001$). Also, the UK birth cohort study reported

similar or slightly higher sleep duration during compared with before lockdown in the MCS 2001 (Bann et al., 2021). Female gender showed more atypical sleep levels (i.e. <6 or >9 hrs.) and sleep differed more by childhood social class and adulthood financial difficulties than in the pre-pandemic data.

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 May 1st 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 ($p < .057$, $N = 106$) in the European sub-sample (Kaditis et al., 2021).

Evans et al. (2021) 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).

Bruni et al. (2021) described the impact of the COVID-19 pandemic on the sleep of participants aged 1 to 18 years with autism spectrum disorder (ASD) in Italy. From May 7th to June 15th 2020 111 parents of children and adolescents followed and diagnosed by a child and adolescent psychiatrist before the survey answered an online questionnaire about their children's sleep patterns and disturbances before and during the lockdown. Results show, that due to the lockdown the bedtime, wake-up time and sleep duration on weekdays changed significantly in 57.8%, and 49.1%, respectively, in 69.2%. Similarly, on weekends, 49.1% reported change in bedtime 44.0% in wake-up time, and 43% sleep duration varied. Regarding the results of the Sleep Disturbance Scale for Children scale participants with ASD reported a significant ($p < .05$) increase of sleep disturbances during the lockdown compared to the preceding period, with difficulty falling asleep

(35.1% vs. 22.5%), anxiety at bedtime (22.5% vs. 10.8%), sleep terrors (5.4% vs. 0%) and daytime sleepiness (14.4% vs. 3.6%).

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 workers³ 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 25th to May 13th 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]).

An Italian online cross-sectional survey (Dondi et al., 2021) in families with children up to 18 years old investigating social determinants of health, mood changes, symptoms of anxiety, increase in sleep disorders and unusual repetitive movements. The focus of the paper was put on sleep changes: emergence or worsening of initiating sleep initiation, maintaining sleep, and nocturnal awakenings after the pandemic outbreak in children. In 4306 (69.3%) families, children had more difficulties falling asleep; the frequency of these episodes was more than twice a week in a third of the children (30.0%). In 1873 (30.2%) families, the children had more difficulties staying asleep; the frequency of these episodes was more than twice a week in a third (30.0%). An increased number of nightmares and/ or sleep terrors was reported in 1163 (18.7%) families; the frequency of these episodes was more than twice a week in 73 (6.3%) cases. Household economic concerns (falling asleep $aOR = 1.38$ ($SD = 0.22$), staying asleep $aOR = 1.38$ ($SD = 0.19$), nightmares $aOR = 1.29$

³ Key worker status was self-assigned based on whether the participant believed their work has been classified as critical to the COVID-19 response

($SD = 0.19$) and household food insecurity (falling asleep $aOR = 2.02$ ($SD = 0.66$), staying asleep $aOR = 2.16$ ($SD = 0.43$), nightmares $aOR = 1.31$ ($SD = 0.27$)), were significantly associated with children's sleep disorders. Strongest significant predictor was mood changes (falling asleep $aOR = 3.16$ ($SD = 0.22$), staying asleep $aOR = 4.85$ ($SD = 0.52$), nightmares $aOR = 2.11$ ($SD = 0.23$)). Further, parents' perception of increased difficulty in the family means after the pandemic, job loss by at least one of the parents, missing out on outdoor activities, and the presence of "chronic diseases" were also significantly associated with sleep disturbances in children.

The study by Chen, Osika et al. (2021) measured the impact of COVID-19 on 15-year-old adolescents ($M_{agebaseline} = 13.6$, $SD = 0.4$ years) in Sweden. They compared 1316 youth who were reexamined in January 2021, not exposed, with 584 youth reexamined after February 2021, exposed to the COVID-19 pandemic. Sleep on school days decreased significantly for both gender over the two-year follow-up. Comparing COVID-exposed boys (8.73 (0.75) vs. 8.08 (0.96)) to controls (8.68 (0.79) vs. 8.16 (0.91)), the decrease in hours of sleep was slightly lower in controls ($p = .066$) but no group differences were observed in girls.

Internet/Social media (and screen time)

Baier and Kamenowski (2020) from the Zurich University of Applied Sciences did a cross-sectional study on adolescents' lockdown experience, in particular regarding school closures, in the canton of Zurich 1103 adolescents aged between 12 and 20 years ($M_{age} = 15.5$ years) years filled out the online questionnaire from April 23rd to May 19th, 2020. Information on the before the lockdown behaviors and activities was reported retrospectively.

The mean score for life satisfaction decreased from 3.14 before the school closure to 3.08 for the time of the survey ($p < .05$). Among students who reported being "very satisfied" with their lives, there was a significant decrease from 33.9% to 28.3% ($p < .001$).

Time spent on screen media (for example movies, internet or computer games) has increased by almost two hours: Before the school closures, the participants spent an average of 3:47 hours on screen media, during the lockdown 5:38 hours. A decrease was observed in all categories of substance consumption (never vs. at least 1-2/week). While 45.5% of the participants drank alcohol at least 1 -2 times/week before the lockdown, only 39.8% did so during the school closures ($p < .001$). For tobacco/cigarette use, the prevalence decreased from 13.7 to 11.1 % ($p < .01$) and for other drugs from 13.7 to 9.5 % ($p < .001$). For sexual cyberbullying, there were no significant changes in prevalence rates (8.6% before, 7.7% during), but psychological cyberbullying decreased from 11.0% before the school lockdown to 8.2% ($p = .01$) during the lockdown. The proportion of

participants reporting high levels of affection from the parents increased from 53.0% to 66.7% ($p = .001$), furthermore, there was a slight decrease in the percentage of respondents who experienced parental violence (from 10.2 to 8.8%; $p = .05$)

Potas et al. (2021) investigated in their cross-sectional study the impact of attitudes on technology addiction (TA) behavior during COVID-19. Three scales were used to determine adolescents' TA awareness, attitude, and behavior. 382 adolescents between 10 and 19 years ($M_{\text{age}} 14.92$; $SD = 3.18$) participated. Data was collected through the self-reported survey method from April 7th to May 7th, 2020. Adolescents reported a moderate level of awareness ($2.07 \pm .37$), positive attitudes ($3.53 \pm .38$), and a high level of addictive behavior ($3.57 \pm .39$) in TA during the COVID-19 period.

Werling, Walitza, Grünblatt, Drechsler (2021) investigated the impact of the Swiss COVID-19 lockdown on screen media behavior in a clinically referred sample in child and adolescent psychiatry. Parents of children and adolescents (10-18 years) who had been in treatment in the last two years at one of the eight outpatient clinics of the Department of Child and Adolescent Psychiatry and Psychotherapy of the University of Zurich (CAPP) participated in the online survey between May 30th and July 4th, 2020, ($N = 477$, 28% response rate). The PUI-Screening Questionnaire for Children and Adolescents (PUI-SQ) and items from the European COVID-19vIruS Health Impact Survey 3.2 (CRISIS) were rated three times: retrospectively before the COVID-19 outbreak (January 2020), during the lockdown (March/April 2020) and during the last two weeks (June 2020/first week of July 2020). The data yield an increased media time during and a decrease after lockdown. Total media time increased by 40.5% during lockdown in male patients (from 4.47 h to 7.51 h) and by 33% in female patients (from 4.77 h to 7.12 h). The repeated measures showed a significant main effect of time ($p < .001$) as well as an interaction of time by gender ($p = .044$). Gender-specific preferences showed an increase of gaming along boys (35% vs 4%) and social media in the female group (43% vs. 17%). The analysis about the effect of the lockdown on specific media-related problem behaviors and risks seemed to have very little effect according to parents' perception. Furthermore, the majority of parents indicted no change (41.10%, $N = 196$), while an improvement of problems was reported by 37.7% ($n = 180$), and a deterioration by 21.2% ($n = 99$). In the children group (10-13 years) the total media time was significantly higher in children showing a deterioration than in those with no change or with an improvement of the psychopathological problem. Whereas in the adolescents' group (≥ 14 years) this effect was not found. Total media time was associated with patients' happiness in both age groups, with more elevated media time in

unhappy than in happy subgroups. Online Homeschooling or time spent outside was not associated with media time.

A retrospective cross-sectional study from Spain (Vall-Roqué et al., 2021) determined the impact of lockdown on social network sites (SNS - Instagram, TikTok, YouTube, Facebook and Twitter) and the association with body image disturbance and low self-esteem. 1620 women (14–24 years old) took part in this online survey. The Data collection was between May 12th and May 17th, 2020. A Wilcoxon Signed Rank Test revealed a statistically significant increase in the frequency of use of all SNS. One-way ANOVA analyses show a significant relation between the frequency of Instagram use and self-esteem ($p = .05$), body dissatisfaction ($p = .05$), and drive for thinness ($p = .01$). Those who spent over two hours per day using Instagram had significantly higher levels of body dissatisfaction and drive for thinness and significantly lower levels of self-esteem, compared to those who reported using Instagram between one and two hours per day. Especially followers of appearance-centered Instagram accounts had significantly higher scores in body dissatisfaction and drive for thinness compared to those who followed other types of accounts on Instagram. All effect sizes were small.

In a paper on the impact of the lockdown on the psyche and media use in children and adolescent psychiatry, Werling, Walitza and Drechsler (2021a) refer to two studies conducted by them. They investigated how the lockdown affects the media behavior and well-being of children and adolescents with psychopathological disorders. An online survey was conducted in the early summer of 2020 at the KJPP Zurich with patients aged 10-18 years and their parents. The majority of parents (41%) indicated that there was no change in the main psychopathological problem during the lockdown, 21% of parents indicated a worsening and 38% an improvement. Patients with internalizing disorders had the highest percentage of improvement (44%). Daily media time (mobile phone, PC, tablet, game console, TV) increased by 59% during the lockdown; for boys, time spent gaming increased most, while girls spent more time on social media. Parents reported almost no changes during the lockdown in digital problem and risk behavior (such as careless handling of personal data or cyberbullying)

Oflu et al. (2021) performed a cross-sectional study on COVID-19 affected screen time and digital gaming habits of Turkish children. Between May 7th and June 27th of 2020, parents of a sample of 253 children between 3 and 10 years ($M_{age} = 6.3$, $SD = 1.4$) participated in a survey. There was a significant increase in screen time of ≥ 1 hour during the pandemic (57.7% vs. 88.8%; $p < .001$), a

significant increase in children watching children's and adult's TV programs (37.2% vs. 52.2; $p < .001$), a significant increase in playing digital games ≥ 1 hours (24.6% vs. 53.3%; $p < .001$). There was no indication of a significant difference between the pre-pandemic or in-pandemic screen time or digital gaming habits by sociodemographic characteristics.

A 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.

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, Walitza, & Drechsler, 2021b).

Scarpellini et al. (2021) explored the experiences in organizing school for children at home and its implications on children's psychological well-being. A cross-sectional, observational study using an online questionnaire was conducted from May 8th to May 15th, 2020 targeting mothers of children aged 6-15 years ($N = 1601$). During distance learning, 48.3% of primary school students presented restlessness during video lessons ($OR = 1.37$, 95 % CI [1.10, 1.72]) and more than half of the middle school students used screens minimum two hours for video lessons per day (59.5%) or for other things than distance learning (51.1%). For 2% of the students an abuse of media use with 8 - 12 hours of screen time was reported.

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

Summary

Several studies focus on children and adolescents with specific diseases and/or health needs during the pandemic. While the patient samples of children with chronic disease are often small in sample size, they most often provide pre-pandemic data for children who are under treatment, in follow-up programs or rehabilitation programs. Regarding acute or emergency care studies most often rely on hospital registry data of high quality and pre-covid data.

Depending on the health endpoint, containment measures can have a 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. A large body of research on diabetic type 1 in children and adolescents consistently indicates no adverse impact on diabetes management and control. Lock-down is even associated with a better metabolic performance in diabetic patient populations with different treatment regimens and technologies. Improvement in metabolic control was more consistently reported for children and young adults, and less in adolescents. The metabolic control was also stable and improved more in adolescents and adults with Phenylketonuria than children. Change and improvement was also seen in studies regarding infection related diseases of the throat, nose, or ears: otitis media and tonsillitis episodes, adenoid or tonsillar hypertrophy symptoms were less frequent or showed less progression. 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. On the other hand, studies point to changes in diagnostics and interventions of certain diseases. The impact of which might only be seen in future. A study on intestinal bowel disease for example reports the lockdown to impact on state-of-the-art diagnostic procedures and consequently treatment.

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. or the closing of specific services altogether. A change in health care utilization is reported consistently early in the pandemic, mostly investigating the lockdown in

spring. They consistently show a large decrease in emergency department (ED) visits during the lockdown, however, the reduction rates in ED visits vary across the studies. Also, diseases specialized centers or primary pediatric practices reported a change in health care provision and access. Overall, most studies yield evidence that contacts for most medical conditions were lower than in comparative time periods. Studies focusing on diagnostics and interventions indicate that elective interventions were often postponed and diagnostic measures, such as colonoscopy or spirometry, to ascertain a diagnosis or as follow-up evaluation were avoided if possible. Literature on vaccinations indicate a drop in childhood and adolescent vaccinations during the lockdown and partly over the pandemic period. Many health utilization studies present hospital or registry data in comparison with same time periods in the years before Corona, others report perception and experiences provided by mostly proxies, such as professionals or parents. These studies suggest that patients avoided health services out of fear of infection and stay-at-home rules. Post-lockdown data is less abundant so far, available literature is inconsistent with regard to catch-up of visits, none could report a full catch-up.

Evidence of patients presenting themselves with higher severity scores in emergency departments is consistently reported and authors imply parents' hesitancy to present their child. Regarding different diagnoses, most studies on emergency departments 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", i.e. patients did not present themselves with these diseases anymore, mostly infectious disease related diagnoses. While some infectious disease cases were seen less by the health care system, the Respiratory Syncytical Virus showed an interseasonal increase. Initial evidence is presented on an increase in mental health diagnoses in ED. Several studies focus on children and adolescents with specific diseases and/or health needs during the pandemic. While the patient samples of children with chronic disease are often small in sample size, they most often provide pre-pandemic data for children who are under treatment, in follow-up programs or rehabilitation programs. Regarding acute or emergency care studies most often rely on hospital registry data of high quality and pre-covid data.

In the screened literature we found only few studies on abuse, and only one including sexual abuse. The literature implies an increase in abuse cases and at the same time indicates the risk of

underreporting of abuse during the COVID_19 pandemic, due to insulation and loss of external contacts, like teachers. Girls seem more at risk for abuse, with exception of physical abuse.

Number of publications: 130

Results

Impact on body weight

5811 parents of children <18 years old participated in a cross-sectional Italian online survey on food insecurity (Dondi et al., 2020), 6 months after outbreak of the COVID-19 pandemic between September 1st and October 15th, 2020. Almost a third (27.5%) of parents reported that their child was eating more and this was more frequent in families at risk of food insecurity. Furthermore, it was reported that the consumption of snacks, sugared fruit juices, and soft drinks increased. Factors associated with increased children's food intake were parental female sex, difficult or unsustainable household economy, more than one child, children older than 2, and children missing outdoor activities. Children older than 14 years were significantly at a higher risk of weight loss. Weight gain was not significantly higher in children from families at high risk of food insecurity.

A study from the UK (Marino et al., 2021) explored the impact of the national lockdown from March to early summer 2020 on nutritional status of 116 children with inflammatory bowel disease, $M_{age} = 13.3$ years ($SD = 2.9$ years), based on anthropometric measurements collected at Southamptons Children's hospital prior (time point 1) and following (time point 2) the national lockdown. The children with initial malnutrition experienced a significant further decline in their nutritional status, change in normal and overweight children was non-significant. 19% of children had mild malnutrition with a mean BMIZ of -1.3 ± 0.9 at time point 1 compared to a mean BMIZ of -1.9 ± 0.9 at time point 2, as well as a statistically significant mean delta change in BMIZ of -0.6 ± 1.5 ($p = .03$). 44% of children in the cohort had a normal BMIZ with a mean score of 0.1 ± 0.6 at time point 1 compared to a mean BMIZ of 0.2 ± 0.6 at time point 2, with a mean delta change in BMIZ of 0.1 ± 0.6 ($p = .5$). Children who were overweight made up 37% of the cohort and had a mean BMIZ score of 1.2 ± 1.2 at time point 1 compared to a mean BMIZ of 1.6 ± 1.4 at time point 2, with a mean delta change in BMIZ of 0.04 ± 0.2 ($p = .5$).

The Italian longitudinal study from Maltoni et al. (2021) aimed to investigate a potential influence of lockdown on the weight changes in adolescents with obesity. The first parameters of $N = 51$ ($M_{age} 14.7$ ($SD = 2.1$ years)) were collected within 2 months before March 8th and the second between

18th May and the end of June 2020. There was a general weight gain during lockdown visible (2.8 ± 3.7 kg ($p < .001$)). The hours of mild physical activity reduced ($+2.9 \pm 2.8$ h/day; $p < .001$) and the hours dedicated to SB decreased (-1.0 ± 1.6 h/ week; $p < .001$) Males gained significantly more weight than females (3.8 ± 3.4 kg vs 1.2 ± 3.7 kg, $p = .02$). There was a significant increase in the hours of sedentary behavior in the group of males, compared to the females ($+3.8 \pm 2.7$ h/day vs $+1.5 \pm 2.5$ h/day; $p = .003$).

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; $p < .001$).

Paulauskaite et al. (2021) nested a survey in an existing RCT trial in children with moderate to severe disabilities (Paulauskaite et al., 2021). 88 parents of 152 participated. During the lockdown and into the early stages of easing restrictions, 90.9% of parents reported difficulties maintaining adequate support for their child and abrupt disruption of access to usual support from health services (76%), education (90.9%), social care, and voluntary sectors (71.7%). Many parents experienced disruption in accessing medical care for their child for both COVID-19 (67%) and non-COVID-19-related health problems (62.5%). Besides this, nearly three-quarters (70%) of parents had difficulties obtaining food, money, and other basic resources, and one in five (21.88%) reported staying in accommodation, they deemed unsuitable as it was lacking sufficient indoor and outdoor space. The study is not generalizable to a wider population.

Impact on chronic diseases/Impact on acute diseases

Under this section we cover impact on chronic and acute diseases both from a patient perspective (symptoms, disease management, treatment, access to care) and a health systems perspective. A number of studies focus on children with specific chronic diseases and/or health needs or on children and adolescents' health care utilization. Others address both preventive care or state of the art screening and diagnostics. Another frequent topic is emergency utilization.

Vaccination:

Mc Donald et 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.

Schmid-Küpke et al. (2021) assessed the extent of cancelled vaccinations, association with vaccination hesitancy and catch-up vaccinations in Germany for children and adults (children: $n = 306$) at different points in time (April 14th, 2020; April 28th, 2020; June 9th, 2020) in the cross-sectional COVID-19 snapshot monitoring (COSMO). The first data collection indicated that 73 out of 306 respondents had vaccination appointments in the last six weeks, of which half were cancelled (children: 42.47). Nearly all of them were cancelled because of the pandemic situation (children: 83.87%). The second data collection indicates that the overall proportion of cancelled appointments for children decreased, only a fourth (24.56%) were cancelled, of which most due to the pandemic situation (85.71%), one third by the physician (33.33%) and two thirds by parents (66.66%). The third data collection shows that more than half of the vaccination appointments took place (58.54%). For children's vaccination appointments, there was no statistical association with any of the parental psychological antecedents of vaccine hesitancy. Almost two thirds of the cancelled vaccination appointments had already been caught up (64.71%) by the end of the study.

A cross-sectional study from Saso et al. (2020) investigated the impact of COVID-19 pandemic on immunization services for maternal and infant vaccines. An online survey was completed from April 15th to April 30th, 2020 of 48 members of the international Immunizing Pregnant Women and Infants Network (IMPRINT). Half of the respondents, medical, public health or laboratory professionals reported disruption in either maternal or infant/toddler vaccine delivery. Issues with delivering vaccines was reported by respondents: maternal vaccines was 54% in LMICs and 42% in HICs,

delivering newborn vaccines 42% in LMICs and 8% in HICs, delivering infant and childhood vaccines 53% in LMICs and 58% in HICs. Thematic analyses yielded three main reasons: “access” issues due to the lockdown, social isolation, and logistical difficulties; “provider” issues, including changes to clinics, staff shortages, lack of personal protective equipment and vaccine supply problems; and “user” concerns, primarily fear of acquiring COVID-19 and vaccine hesitance

The Swiss Helsana Report compared their own insurance data during the years 2018 and 2019 with 2020. They found a change in vaccinations in children and adolescents. The pattern of change was vaccine specific, Diphtheria, Tetanus and Polio (DTP) dropped from 76.2% to 71.1 % vaccination rate and Mumps, Measles and Rubella (MMR) from 52.7% to 46.3%. For MMR the drop was most prominent during the first and second wave. Other vaccines yielded less change: Hepatitis B (65.9 to 64%) or Pneumococcus (66.1% to 65.8%) (Bähler et al., 2021).

Health care for children with specific diseases

An Italian cross-sectional study from Trivisano et. al. (2020) investigated the impact of COVID-19 on pediatric epilepsy patients. 3321 respondents filled out a questionnaire in a time frame of 26 days beginning on May 8th, 2020. The results show that seizure frequency remained stable during the lockdown period (increased in 13.2%; decreased in 20.3%), and seizure duration, use of rescue medications, and adherence to treatment were unchanged. Comorbidities worsened such as behavioral problems 35.8%; sleep disorder worsened 17.0%). Visits were canceled/postponed in 41.0%, and 25.1% had remote consultation during the lockdown period.

Riccio et al. (2020) recruited 27 **primary ciliary dyskinesia** (PCD) patients and 27 healthy controls in Italy. The PCD pulmonary exacerbations occurred less frequently, and weekly chest physiotherapy sessions significantly increased compared to the same period during 2019 ($p < .05$).

A cross-sectional Italian study from Dallavalle et al. (2020) investigated **migraine** symptoms improvement during the COVID-19 lockdown in children and adolescents ($N = 142$) with diagnosis of migraine. Parents were completing an online survey from March to April 2020. The results show that significant reduction of migraine symptoms intensity and also frequency was observed. All the patients reporting worsening symptoms progression before COVID-19, had reduced intensity during the lockdown ($p < .0001$). Symptom frequency reduction was observed in 50% of patients

presenting worsening symptoms before the lockdown, 45% of those who were stable, and 12% of those who were already improving. All patients who had resolved symptoms before COVID-19 were stable during the lockdown ($p < .0001$). During the lockdown, anxiety symptoms worsened in 37 patients (26.1%), were stable in 104 patients (73.2%), and improved only in one patient. Anxious symptomatology was significantly associated with greater migraine symptoms frequency ($p < .001$), but not intensity ($p = .54$).

In their Italian multicenter study Papetti et al. (2020) investigated whether and how the course of **primary headache disorders** in children and adolescents treated in one of nine pediatric headache centers, age 5 to 18 years, had changed ($N = 707$ children or parents). Comparing the “trend of the headache” during lockdown to the previous 2 months: 323 patients improved (46%), 277 remained stable (39%) and 107 worsened (15%). Stable patients were more likely to have decreased intensity or frequency of attacks rather than an increase ($p < .0001$). Furthermore, results show a significant relationship between age and primary endpoints. In particular, the probability of having a worsening of the trend of headache ($\rho = 0.15$; $p < .0001$), and intensity ($p < .0001$) and frequency ($p < .0001$) of the attacks increased with increasing age. Reduced school effort improved headache ($p < .0001$), while school anxiety ($p < .0001$) and the duration of the headache ($p < .0001$) favored headache worsening. The severity of the headache before the lockdown was associated with an improvement and intensity of the attacks ($p < .0001$). Patients under prophylactic therapy showed a worsening of both the trend of headache and intensity of attacks ($p < .05$). Worsened intensity of attacks was significantly associated with generalized anxiety ($p < .05$), and worsened frequency of attacks with depressed mood ($p < .05$).

An online survey from Tse et al. (2021) co-produced with patients was conducted in May 2020 in the United Kingdom amongst children and young adults (CYA) aged 12–30, or parents of children aged < 18 years with any **long-term kidney condition**. One-hundred and eighteen CYA ($M_{\text{age}} = 21$) and 197 parents of children ($M_{\text{age}} = 10$) responded. Predominant concerns from CYA were heightened vigilance about viral (68%) and kidney symptoms (77%) and detrimental impact on education or work opportunities (70%). Parents feared the virus more than CYA (71% vs. 40%) and had concerns that their child would catch the virus from them (64%) and would have an adverse impact on other children at home (65%).

Handberg et al. (2021) analyzed the effect of COVID-19 on biopsychosocial health, daily activities, and quality of life among people with **neuromuscular diseases**. With a national questionnaire

survey parents of 67 children (range = 3–15 years; $M_{age} = 10.1$ years) between December 14th and December 18th, 2020 (and 811 adults not reported here). Most of the parents (49.3%) reported their child's health as good, or better than good (44.8%). Only 6.0% of the parents reported fair health and none rated poor health. Most parents (67.2%) reported that their/their child's health was the same as a year ago, 17.9% rated their/their child's health as somewhat worse. 81% of the children experienced a reduced quality of life due to the COVID-19 pandemic, while 8.6% reported an improvement of the quality of life. Medical and hospital appointments were carried out as planned during COVID-19, while children who got physiotherapy experienced a modification in the delivery of physiotherapy during the pandemic. 40 out of 67 parents reported that the chance of getting infected with COVID-19 scared their child. 17 parents (51.5%) stated that they had abstained from getting personal assistance for themselves or their child due to the risk of COVID-19 infection for a little of the time or more during the pandemic

A cross-sectional pilot study from Stathopoulos et al. (2021) was designed to assess bowel function and quality of life (QoL) in children and adolescents (5-16 years old) with **congenital colorectal malformations** (CCM) during the first UK COVID lockdown period (Mai-June 2020). 32 families were interviewed (21 Boys and 11 Girls). Most (19,59%) reported no change in their child's health during lockdown, while 8 (25%) reported an improvement and 5 (16%) parents reported a deterioration. There was no correlation between the severity of the CCM, the degree of bowel dysfunction and the deterioration in the child's health, nor between the overall Hirschsprung's disease anorectal malformation quality of life questionnaire (HAQL) score and the report of a deterioration in the child's health ($p = .97$). Parents explained the improvements with a better control of their child's diet, better control of their child's scheduling and the absence of peer's judgement. Reasons for the deterioration were less social contact and less physical exercise.

Naddei, Alfani, Bove, et al. (2021) examined the rate of disease flare before and during COVID-19 lockdown on disease course in children diagnosed with **juvenile idiopathic arthritis** (JIA). In their single-center retrospective study they conducted data of the medical records at the Pediatric Rheumatology Unit of the University of Naples Federico II in South Italy. They compared data of two groups with inactive disease (ID) Group A (before COVID, $N = 126$) had baseline data from September 1st, 2018 - March 9th, 2019 (V1) and were re-evaluated between March 10th, 2019 and June 30th, 2019 (V2); Group B (after COVID, $N = 124$) provided baseline-data between September 1st, 2019 and March 9th, 2020 (V1) and were re-evaluated between March 10th, 2020 and June 30th, 2020 (V2). Clinical and demographic features at baseline were comparable, the median age at V1

was 10.9 years in both cohorts. They collected demographic data and disease specific information (JIA subtype, age at JIA onset, co-occurrence of uveitis, antinuclearantibody (ANA) positivity, disease duration and past therapeutic regimens)The rate of relapse was significantly higher in group B (21/124, 16.9%, 95% CI [10.8, 24.7%]) in comparison to group A (8/126, 6.3%, 95% CI [2.8, 12.1%]) ($p = .009$) and new drug was started in 15.3% patients of group B compared to 6.3% of group A ($p = .022$), 33.3% of the relapsed patients had to wait for a face-to-face appointment for over a month.

In a cross-sectional single centre retrospective study from the UK, Heward et al. (2020) investigated the impact of social distancing measures on 44 children ($M_{age} = 7.6$ years; range = 1.9–14.9 years) on the **tonsillectomy** waiting list for recurrent tonsillitis 2 months after the coronavirus lockdown, conducting telephone questionnaires with their parents. The lockdown period (March 23rd, 2020 - May 17th, 2020) was compared with the 2 months period prior to lockdown (January 27th, 2020 - March 22nd, 2020.) Results show a significant decrease in the numbers of tonsillitis episodes during the lockdown period compared to the period prior to lockdown ($M = 1.80$, $SEM = 0.17$ vs. $M = 0.84$ ($SEM = 0.17$; $p = .0001$). Regarding antibiotic requirement for tonsillitis, the patients use significantly decreased from the pre-lockdown period (70% of patients) to the lockdown period (32% of patients) ($p = .0002$). Presentations to hospital because of tonsillitis fell from 4 patients in the pre-lockdown period to zero during the lockdown period.

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 ($p < .0001$).

An Italian study yielded a lower incidence of in otitis media with effusion during the pandemic period compared with 2 previous non-pandemic years. Percentage variation in incidence between the first

and second non-pandemic year and the pandemic year was 63% and 68% respectively with an absolute decrease of 305 cases in both comparisons (Iannella et al., 2021).

Aldè et al. (2021) evaluated the role of social isolation during the lockdown in Italy on the prevalence of otitis media with effusion (OME) and the natural history of chronic OME. A total of 932 children aged between 6 month and 12 years referred to the outpatient clinic for hearing or vestibular disorders during two the periods before the lockdown from May to June 2019 ($n = 350$) and January to February 2020 ($n = 366$) and the period after the lockdown from May to June 2020 ($n = 216$) were assessed. The prevalence of OME in the total clinic population was 40.6% in the first period from May to June 2019, increased to 52.2% in January-February 2020, and decreased to 2.3% in the third period from May-June 2020. The prevalence difference between the third and first period was -38.3% (95% CI [-43.8%, -32.7%]). Children with chronic OME who were diagnosed in summer 2019 and checked again in May to June 2020 had a much higher rate of disease resolution ($n = 29$, 93.3%) than those diagnosed in Summer 2018 and reevaluated in May-June 2019 ($n = 30$, 20.7%; $p < .001$).

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. Studies observed no clinically relevant differences between in-pandemic and pre-pandemic periods regarding the overall metabolic control (Passanisi et al. 2020, Schiaffini et al. 2020, Cusinato et al. 2021, Tinti et al. 2021, Cognigni et al. 2021). Most studies found no difference in total insulin dose and the basal insulin delivery (Tornese et al., 2020; Schiaffini et al., 2020; Christofordis et al., 2020) while some report 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 (Christofordis et al., 2020).

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 ± 0.84 vs. 7.44 ± 0.83 , $p < .001$), GMI (7.60 ± 0.75 vs. 7.37 ± 0.70 , $p < .001$), %TAR (43.4 ± 16.2 vs. 38.0 ± 15.8 , $p < .001$), mean glucose (mg/dl) (178.6 ± 31.2 vs. 169.1 ± 28.6 , $p < .001$), and a higher %TIR (52.6 ± 15.2 vs. 58.0 ± 15.1 , $p < .001$). The analysis shows a statistically significant difference ($p < .05$) between T0 and T1 with regard to BMI (20.9 ± 3.7 kg/m² vs. 21.5 ± 4.6 kg/m²) and basal insulin dose (21.1 ± 9.3 IU/day vs. 22.3 ± 10.2 IU/day) in female but not in male patients.

A cohort study from Italy (Cusinato et al., 2021) in 117 youths aged 12-20 years old ($M_{age} 15.9; \pm 2.3$) with type-1 diabetes studied the impact of lockdown measures and psychological wellbeing on glycemic metrics recorded by continuous glucose monitoring. Glycemic data recorded between the

30. March and 12. April 2020 was compared to the same period in the previous year. Psychological wellbeing was measured with a standardized Test, the Test of Depression and Anxiety Scale (TAD). The median percentage of time in target glycaemic range (TIR) increased by 10% during the lockdown period compared to the control period, from 49% to 59% ($p < .001$). Children with a more recent diagnosis had a greater increase in TIR. The percentage of time in moderate and severe hypoglycemia was reduced significantly ($p = .002$, respectively $p = .001$) as well as the percentage of time in hyperglycemia ($p < .001$). 16% of youths showed a significant score for depression while 7% showed significant score for anxiety. A higher score for depression or anxiety was - when adjusted for age, sex and diabetes duration - associated with a lower TIR ($p = .012$ for depression and $p = .028$ for anxiety).

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.

Tinti et al. (2021) analyzed the impact of lockdown during COVID-19 on glucose metrics in 66 children and adolescents with T1DM ($M_{\text{age}} = 11.6$, $SD = \pm 4.5$) using a continuous glucose monitoring (CGM) in Italy. Time spent in range (TIR), below range (TBR), above range (TAR), as well as coefficient of variation (CV), sensor use, and glucose management index (GMI), were extracted during 90 days of lockdown (February 24th, 2020 - May 24th, 2020) and compared to data from the preceding 90 days (November 25th, 2019 - February 23rd, 2020). Before the lockdown period, participants showed a mean glucose of 168 ± 61 mg/dL (9.3 ± 3.4 mmol/L), during the lockdown it was 165 ± 58 mg/dL (9.2 ± 3.2 mmol/L) ($p < .05$). There was an increase in TIR from $59.7 \pm 13\%$ to $62.5 \pm 14\%$ ($p = .001$), while TAR decreased from $37.8 \pm 14\%$ to $35.2 \pm 15\%$ ($p = .004$). No significant changes were found for TBR (from $2.5 \pm 2.3\%$ to $2.3 \pm 2.5\%$, $p = .177$) and GMI (from $7.5 \pm 0.9\%$ to $7.4 \pm 0.8\%$, $p = .05$). Furthermore, a decrease in the CV from $36 \pm 5\%$ to $35 \pm 5\%$ ($p = .003$) was observed. The time per week spent on physical activities reduced from 6.1 ± 3.3 h to 2.7 ± 3.1 h ($p < .001$), while the total daily insulin dose (TDD) increased from 0.79 ± 0.25 UI/kg/day to 0.87 ± 0.31 UI/kg/day ($p = .004$). An increase in CGM use from 87 ± 17 to $92 \pm 10\%$ of time was observed ($p = .006$).

An Italian study by Cognigni et al. (2021) evaluated the effects of the COVID-19 lockdown on HbA1c and body mass index (BMI) in 50 children and adolescents in ambulant care at a Diabetes Paediatric Unit of the Institute for Maternal and Child Health ($M_{age} = 15.0$ years (IQR, 11.9–17.2)) with type 1 diabetes (T1DM, treated with continuous subcutaneous insulin infusion (CSII) using continuous or flash glucose monitoring. Pre-lockdown data from 6. December 2019 to 8. March 2020 was compared to post-lockdown medical records from 4. May to 5. August 2020. HbA1c dropped from a pre-lockdown median 60 mmol/L (IQR 53–66) to a median 57 mmol/L (IQR 53–65) at the first visit after lockdown ($p = .04$). Children with high HbA1c baseline values showed a significantly higher trend of reduction ($p < .001$). No significant increase in the median BMI SDS during the lockdown was detected (pre-lockdown: 0.27 SDS (–0.27–1.18); post-lockdown: 0.35 SDS (–0.23–1.29) ($p = .81$). 88% reported a reduction of physical activity.

An Italian longitudinal study from Di Dalmazi et al. (2020) compared differences of the effect of COVID-19 lockdown on glucose patterns between children ($n = 30$), adolescents ($n = 24$) and adults ($n = 76$, >18 yrs.) with type 1 diabetes. Glucose time in range and glucose variability data was collected from Continuous Glucose Monitoring (CGM) system twenty days before the lockdown and twenty days after the lockdown (time range = February 20th to 30th March), for children also from 30th January – 19th February, during which the schools were still open. Participants provided data on physical activity (IPAQ-SF questionnaire) and stress (PSS questionnaire). In children SDglu (glucose management indicator), TBR2 (Time below range) and LBG1 (Low blood glucose) were significantly lower between pre-lockdown and during lockdown, while, whereas adolescents didn't show significant changes in the parameters. These changes may be due to the more regular mealtime during lockdown and parents paying closer attention to the eating behaviors of their child. Comparing school-open pandemic period with pre-lockdown period only TAR (time above range) in children was slightly increased ($p = .047$) and SDglu was lower in adolescents ($p = .041$) in the school-open period. A separate analysis of 18 – 26-year-olds ($n = 10$), had a significantly lower TIR in lockdown vs. pre-lockdown and a lower SDglu in pre-lockdown vs. lockdown.

A study by McGlacken-Byrne et al. (2021) investigated presentations of newly diagnosed type 1 diabetes in children (<18) across North Central London over a one-year-period. The aim was to compare the severity of presentations occurring before and during the first COVID-19 wave, using data from the electronic patient records of four regional inpatient centers. Over the one-year study period, 30 children presented with new-onset diabetes type 1 pre-pandemic and 17 during the first

wave. In children presenting during the first COVID wave, the mean pH (degree of acidosis) was lower (7.09 ± 0.21 vs. 7.30 ± 0.13 ; $p = .001$) and first glycated haemoglobin HbA1c measurement was higher (13.0 ± 1.7 vs. $10.4 \pm 3.2\%$; 119 ± 19 vs. 90 ± 35 mmol/mol; $p = .008$). The proportion of children presenting in diabetic ketoacidosis (DKA) was significantly higher during the first wave compared to pre-pandemic (pre-pandemic: mild 13%, moderate 6.7%, severe 10%; first COVID-19 wave: mild 5.9%, moderate 24%, severe 47%; $p = .002$). While pre-pandemic, younger children were more like to present in severe DKA (3.9 years vs. 12.2 years; $p < .001$), this difference was not significant during the first wave 10.1 years vs. 11.2 years; $p = .568$). Children with diabetes type 1 in the family presented less severe than children without this family history. Overall, results show that presentations of newly diagnosed childhood onset type 1 diabetes were more severe during the first wave of COVID-19 compared to pre-pandemic months.

A retrospective observational cohort study (Minuto et al., 2021) evaluated the glycemic control in a large sample of 202 young T1D patients, aged 6 to 39 years ($M_{age} = 18.3$ years, $SD = 6.43$ years), during the lockdown period with particular attention to the role of age, type of insulin therapy, number of telemedicine visits and physical activity. Overall, glycemic control improved, although not statistically significant, in the primary school children group (TIR $58.33 \pm 21.14\%$ at T0 and $61.49 \pm 19.76\%$ at T1) and remained almost stable in the first-grade secondary school children group (TIR $55.74 \pm 16.30\%$ at T0 and $56.84 \pm 16.91\%$ at T1). On the other hand, glycemic control significantly improved in the second-grade secondary school students group ($51.96 \pm 16.73\%$ at T0 and $56.71 \pm 19.42\%$ at T1, $p \leq .005$) and even more in the university students and young adults group ($55.40 \pm 16.53\%$ at T0 and $61.37 \pm 16.62\%$ at T1, $p \leq .001$). A statistically significant reduction in the weekly sports hours was observed in all groups: in "primary school children" group (4.36 ± 0.94 h at T0 and 0.14 ± 0.38 h at T1, $p = .02$), in "first grade secondary school children" group (6.01 ± 4.06 h at T0 and 1.82 ± 2.32 h at T1, $p \leq .0001$), in "second grade secondary school students" group (5.14 ± 4.20 h at T0 and 2.72 ± 3.40 h at T1, $p \leq .0001$) and in "university students and young adults" group (3.74 ± 4.33 h at T0 and 2.7 ± 3.49 h at T1, $p = .03$). The expected negative effect of reduced physical activity was offset by the positive "lockdown effect" of greater glycemic control.

In a retrospective and longitudinal observational study Predieri et al. (2020) evaluated the effects of lockdown in Italy on glycemic control in 62 children and adolescents ($M_{age} = 11.1 \pm 4.37$ years; 50% males) with Type 1 Diabetes (T1D) which were using a real-time continuous glucose monitoring system and were followed through telemedicine. Data from the 3-month period from November 26th, 2019 to February 23rd, 2020 (T0) and the 85 days of lockdown from February 24th to May 18th, 2020

(T1) was analyzed. No change in insulin total daily dose was observed over the time, while the time spent on physical activities was significantly lower at T1 compared to T0 (0.24 ± 0.59 vs. 3.27 ± 2.82 h/week, respectively; $p < .0001$). The median time in range (TIR 70-180) increased from 60.5% to 63.5% ($p = .008$), time above range (TAR > 180) decreased from 37.3% to 34.1% ($p = .048$), and time below range (TBR < 70) decreased from 1.85% to 1.45% ($p = .001$). The median value of the glucose management indicator slightly decreased from 7.4% to 7.25%, even though not statistically significant ($p = .069$). Glucose standard deviation ($p < .0001$) and coefficient of variation ($p = .001$) improved during the time of the study.

Lombardo et al. (2021) evaluated the glycemic control during the lockdown period compared to the previous and the following months, in a cohort of pediatric patients (5–18 years) with T1D on intensive insulin therapy who regularly use continuous glucose monitoring (CGM) systems. Secondary outcome was the influence of age or treatment type on the changes of diabetes outcomes before, during, and after the COVID-19 lockdown. Data was collected from 85 patients at the University Hospital of Messina (Italy) in three different periods of 90 days each: December 10th, 2019 to March 9th, 2020 (1. pre-lockdown phase); March 9th to June 6th, 2020 (2. lockdown phase); June 7th to September 4th, 2020 (3. post-lockdown phase). Of the 85 patients, 22.4% were on MDI (multiple daily injections of insulin) therapy, 29.4% used HCL (hybrid closed loop insulin pumps) systems, and the remaining 48.2% belonged to the CSII (insulin pumps with non-automated delivery system) group. There was a significant increase of TIR (time in range) at Period 2 and Period 3 compared to Period 1 ($p < .001$ both). Similarly, across the different time points, there was a significant reduction of TAR (time above range, $p < .001$ both) and GMI (glucose management indicator, $p < .001$ and $p = .015$). Glucose Variability (%CV) was significantly lower in Period 2 than in Period 1 ($p = .003$), whereas %CV in Period 3 significantly increased compared with Period 2 ($p < .001$). TBR (time below range) remained unchanged between Period 1 and Period 2, whereas TBR in Period 3 was significantly higher than in Period 2 ($p = .004$). TAR was significantly lower in Period 2 compared to Period 1 in all the age groups ($p < .001$ for 5–9 years; $p = .003$ for 10–14 years; $p = .007$ for 15–18 years). Patients that belonging to the HCL group significantly improved glucose metrics, particularly in terms of TIR ($p < .001$), TAR ($p = .001$), and %CV ($p = .005$) in Period 2 compared to Period 1. Better TIR and TAR levels were also observed in Period 3 in comparison with Period 1 ($p < .001$ both). By comparing Period 1 and Period 2, in the CSII group, TIR, TAR, and GMI significantly improved in Period 2 ($p = .002$ for TIR; $p = .002$ for TAR; $p = .003$ for GMI), and patients on MDI therapy also showed better TIR and TAR levels ($p = .004$ both).

Loh et al. (2021) analyzed the clinical presentation and manifestation of diabetes mellitus in 125 children and adolescents (<6–18 years) in Germany (in one University Hospital), comparing the same time period (March to October) in 2019 and 2020. In 2020 extreme obesity was present more often than in 2019. 25% of the children with new onset DM had a BMI >99.5 percentile. More patients were diagnosed with diabetic ketoacidosis (DKA) in 2020 (28.8%, of which 53.3% severe) compared to 2019 (20.5%, of which 40% severe). Among patients with new onset DM DKA was more frequent (66.7%, of which 62.5% severe). Common symptoms of diabetes manifestation were present in 73% of the children during lockdown in 2020 while in 2019, only 68.4%. Polydipsia was the most frequent symptom in both years (23.1% in 2020; 19.2% in 2019). In newly diagnosed children there was a significant increase in hospital days and a decrease in base excess, indicating a higher DKA.

A sample of $N = 1983$ patients with **celiac disease** (CD), 1614 adult patients (81.4%, > 18 years) and 369 (18.6%) parents/caregivers of CD children/adolescents (<18 years), took part in a cross-sectional web-based survey launched by the Italian Celiac Society between April 29th to June 1st, 2020 on the adherence to gluten-free diet (Monzani, Lionetti, et al., 2020). For the majority of the participants the compliance with the GFD was unchanged (CD adults: 69%; parents of CD children: 70%), a third even reported an improvement in the adherence to the GFD. The most mentioned cause in both groups for an improved adherence was "not eating away from home" (CD adults: 75%; parents of CD children: 64%). The presence of CD symptoms in the last year before the lockdown ($OR = 2.05$, 95% CI [1.21, 3.47]), still positive CD antibodies ($OR = 1.89$, 95% CI [1.14, 3.13]), and other family members with CD ($OR = 2.24$, 95% CI [1.3, 3.85]) increased the probability of improved compliance during the lockdown.

An Italian study on **recurrent preschool wheezers** ($n = 85$), $M_{age} = 4.2$ 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 ($N = 41$; $M_{age} = 11.02$; $SD_{age} = 2.25$). An online survey was conducted after the lockdown from May 28th, 2020 to August 23rd, 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.

Ferraro et al. (2021) analyzed the impact of the COVID-19 pandemic and the lockdown on the level of asthma control and maintenance therapy in 92 asthmatic children (72.8% male; mean age: 12 (\pm 3) in Italy (Ferraro et al., 2021). Asthma control improved, the GINA score was significantly lower in March 2020 ($p = .023$) and in April 2020 ($p = .007$) compared to same periods in 2019. Compared to 2019, in 2020 more children changed their maintenance therapy (14/92 [15.2%] vs. 35/92 [38%]; $p < .001$). There was a significant increase in both of children who increased (2019: 2/92 children [2.2%] vs. 2020: 10/92 children [10.9%]; $p = .033$) and children who reduced (2019: 12/92 [13%] vs. 2020: 25/92 children [27.2%]; $p = .026$); their maintenance therapy, indicating both asthma symptom worsening and improvement. In a subsample of 13 children with severe asthma treated with Omalizumab asthma control was equally good.: the GINA score was significantly lower in March 2020 ($p = .011$) as well as in April 2020 ($p = .017$) compared to 2019. A subgroup of 39 children (> 12 years), who suffered also from allergic rhinitis, no significant difference in Rhinitis Control Assessment Test score (RCAT) was found

Yucel et al. (2021) evaluated the effects of the lockdown in Turkey on 165 mild-moderate asthmatic children with or without allergic rhinitis (AR) ($M_{age} = 8.5$ years; IQR = 6.8,10.8 years) comparing data from the periods March to May 2019 and 2020. During the period from March – May 2020 there was a significantly reduced number of upper respiratory tract infections ($p = .008$) and reduced asthma exacerbations ($p < .001$) compared with the same period in the previous year, furthermore, a significant reduction in the number of antibiotic prescriptions for upper respiratory tract infections was observed in the period in 2020 compared to the same period in 2019 ($p < .001$). Regarding asthmatic children without allergic rhinitis, the three-month average asthma control tests were significantly improved both in house dust mite (HDM)-sensitized ($p = .003$) and HDM-non-sensitized patients ($p < .001$).

A French study investigated the effect of the pandemic on 92 children with psoriasis between June 10th to June 29th, 2020. During the lockdown, psoriasis worsened in 47.3% of the children and 18.8% stopped their systemic treatments, mainly for reasons linked to the pandemic. The most common patient-identified causes inducing flares, worsening of symptoms, were stress (48.8%) and treatment interruption (18.6%) (Beytout et al., 2021)

Rovelli et al. evaluated whether and how the pandemic impacted metabolic control in children with **Phenylketonuria** (PKU). PKU is an inborn error of phenylalanine (Phe) metabolism (Rovelli et al., 2021). Dietary intervention is the main recognized treatment and must be maintained throughout life to reduce Phe blood levels and avoid central nervous system damage. PKU-Patients followed-up at a Metabolic Clinic in Italy were enrolled and divided into subgroups according to age (Group A 4 - 12 yo [pediatric population]; group B \geq 12 yo [adolescent and adult population]). Collected dried blood spots (DBS) were studied and compared to previous year same time-periods. The number of performed DBS increased in 39% of the patients ($n = 121$). "Non-compliance" was reduced from 11% to 3%). In children, Group A, maintained substantially unchanged metabolic control among two analyzed time-periods (March-May 2019/20), indicating unchanged parental control. On the contrary, adolescents and adults, group demonstrated significant reductions in mean blood Phe concentrations ($p < .0001$) during the pandemic ($M = 454 \text{ umol/l}$, $SD \pm 252$, vs. 556.4 umol/l , $SD \pm 301$). The improvements in group B indicate better dietary control during the lockdowns possibly due to more spare time to spend cooking and consuming substitutes more regularly.

Herle, Brunner-Krainz, Karall, et al. (2021) examined in their study the effects of the Austrian lockdown for 77 school-aged children between 8 and 19 years with classical Phenylketonuria (PKU). They compared the differences of the number of phenylalanine (Phe) measurements and Phe concentrations between the national lockdown (March 16th to December 4th, 2020) and the same period before the pandemic (March 16th to December 4th, 2019). From 2019 to 2020 the number of patients who sent in their dried blood samples (DBS) for Phe measurements decreased ($p < .001$). The number of patients with none or one DBS increased from 4 (5.2%) in 2019 to 12 (15.6%) in 2020. Further analyses showed that patients >16 sent significantly less DBS in 2020 ($T = 156$, $p = .02$). With regard appointments in 2019 13 patients (17%) had two appointments while in 2020 only one patient (1.3%) had the two regular check-ups, and only four patients (5%) received a telemedicine consultation. There was no significant difference between 2019 and 2020 found in the median Phe concentrations from DBS ($T = 782.5$, $p = 1.00$) or from the venous blood samples ($T = 602.5$, $p = .88$). Further there was no significant change in the number of people who kept their

median Phe concentration within the suggested range. However, people with a good median Phe concentration in 2019 sent significantly less DBS in for Phe measurement in 2020 (*Mdn* 2019 = 7; *Mdn* 2020 = 5; $T = 577$, $p = .01$, $r = .36$). Differences between their Phe values, which were slightly higher in 2020, were not significant. Patients with a median Phe above the recommended range in 2019 showed no significant differences in the number of Phe measurements or the average of the Phe concentrations. The subgroup analyses by gender or dietary only versus dietary plus sapropterin treatment did not show any significant relations with the frequency of DBS measurements or the median Phe between 2019 and 2020.

Van Brusselen et al. (2021) examined the impact of COVID-19 on **Bronchiolitis**, viral lower respiratory tract infection mainly caused by the Respiratory Syncytial Virus (RSV), by consulting the registered positive RSV tests from Belgian sentinel laboratories and participating hospitals (Van Brusselen et al., 2021). The total number of RSV infections per year reported in the past three years by the sentinel laboratories was on average 9986, 7568 of them before week 52. In more than 80% of the cases, the patients were younger than 3 years. In the 2020 winter season only 20 positive RSV cases were registered before week 52 in Belgium, corresponding to a reduction of >99%. Furthermore, bronchiolitis hospitalizations before week 52 dropped by 92.5% compared to the last 3 years.

A study from Fourgeaud et al. (2021) describes the consequences of public health measures on **Respiratory Syncytial Virus** (RSV) (seasonal) outbreaks and infections in France. Overall 664 patients (229, 183, and 252 during the 2018/2019, 2019/2020, and 2020/2021 outbreaks), respectively were admitted to one hospital in Paris between August 2018 and April 2021 with a diagnosis of RSV-associated acute lung respiratory infection (ALRI) Compared to previous RSV outbreaks, the 2020/2021 outbreak was delayed (interseasonal) and involved more children aged 6 to 11 months (25.8% vs. 13.1%; $p < .0001$), but less infants aged < 6 months (41.3% vs. 56.6%; $p < .0001$) and less adults (0.0 vs. 2.7%; $p < .0001$). Shorter length of stay at hospital, less frequent requirement of admission to intensive care unit, use of non-invasive ventilation, and/or high-flow nasal oxygen were observed in 2020/2021 than during previous epidemics ($p < .0001$). Overall, the delayed RSV outbreak was associated with more hospitalizations for ALRI, higher age of pediatric inpatients, but milder median clinical phenotype.

A British study from Nicolay et. al. (2020) investigated the epidemiology of **measles** during the COVID-19 pandemic using data from the European Centre for Disease Prevention and Control

(ECDC). The results show that between January 1st, 2020 and May 31st, 2020, 1917 1,246 measles cases were confirmed, 390 reported as probable and 276 as possible cases (five unknown) to the median age of cases was 7 years and mean age was 14 years (IQR = 1–25). Since January 2010, it was the second lowest number of cases ever reported during a measles peak season (1104 cases between January and May 2016).

A retrospective and single-center designed study (Aslan & Sahinoglu-Keskek, 2021) evaluated the effect of the COVID-19 pandemic restrictions on **myopia progression** (MP) in 115 children aged 8-18 (M_{age} : 12.06 (± 2.29), who had been followed-up for at least three years at an Eye Clinic in Turkey. The mean duration of using glasses was 3.57 ± 0.74 years. Only the right eyes were included in the analyses. In the years 2017, 2018 and 2019 before home education, the annual myopic progression (MP) was 0.49 (± 0.26), 0.41 (± 0.36) and 0.54 (± 0.43) diopters, respectively, ($p > .05$), and .71 (± 0.46 .) diopters in 2020 during home education. The increase in MP t in 2020 compared to 2019 and 2018 was statistically significant ($p < .003$). For children who participated in open-air activities for 2 hours a day and those who lived in detached houses, MP was statistically significantly lower ($p = .004$, $p = .006$, respectively).

While many studies argue that emergency department cases went down due to less infectious diseases, a study from Finland shows, that the reduction of infectious transmissions was not the case for all infectious agents. **Rhinovirus infections** reported by the National Infectious Disease Register, maintained by the Finnish Institute of Health and Welfare showed a decrease during the lockdown with school closures and strict physical distancing, mainly in 0–4 years-olds (weeks 14 to 22 in 2020), but increased right after the lockdown measures were lifted (June 2020) and rates of rhinovirus findings returned to normal levels and later remained stable (Kuitunen et al., 2021).

Utilization and access of health services (hospitalizations, specialized care or primary care & preventive care)

In an observational study, Ibrahim et al. (2021) examined the effect of the COVID-19 pandemic on the pediatric **trauma burden** upon a single UK district general hospital and compared the nature and volume of pediatric trauma during the lockdown (March 23th to June 14th, 2020) with the same period in the previous year (March 23th to June 14th, 2019). During the lockdown in 2020, there was a decrease of 30% in pediatric trauma presentations compared to the same period in 2019 (441 vs. 306; $p < .001$), but no significant change was observed in the number of patients that required surgery (51 vs. 47; $p = .686$). The absolute numbers of fracture presentations decreased (279 vs

185; $p < .001$) as well as soft tissue injuries (162 vs. 123; $p = .021$), however, the proportion of soft tissue injuries of all injuries increased, even though not significantly. Furthermore, there was an increase in proportion of trampolining injuries (5.7% vs. 21.8%; $p < .001$) and a decrease in proportion of high energy trauma from road traffic accidents and falls from height (37.4 vs. 15.9 %; $p < .001$).

Martin et al. (Martin et al., 2021) conducted a retrospective case series to assess pediatric **eye injuries** by alcohol-based hand sanitizers (ABHS) in the context of the COVID-19 pandemic between April 1st and August 24th, 2020 and the same period in the previous year. Data from children under the age of 18 were retrieved from the national database of the French Poison Control Centers (PCC) and from a pediatric ophthalmology referral hospital in Paris. In 2020, there was a significantly lower number of calls to PCCs associated with chemical eye splatter in children compared with the same period in 2019: 2336 cases (2.2% of pediatric calls) in 2020 vs. 2553 cases (4.2% of pediatric calls) in 2019 (difference: 2.0%; 95% CI [1.9, 2.2]; $p = .001$). However, there was 7-fold increase in pediatric cases of ABHS eye exposures from 1.3% in 2019 (33 cases; $M_{age} = 3.4$ years, $SD = 3.8$) to 9.9% in 2020 (232 cases; $M_{age} = 4.5$ years, $SD = 3.5$); (difference = 8.6%; 95% CI [7.4, 9.9]; $p = .001$). While there was no reported case of ABHS exposure in a public place in 2019, the numbers increased in 2020 from 16.4% in May to 52.4% in August. Data from the referral hospital showed that in 2020 a total of 1657 children were admitted to their ophthalmology emergency department, of which were 80 (5%) for a chemical eye splatter while there were 98 cases (4%) of eye splatter registered among 2469 pediatric consultations during the same period in 2019. However, no difference was found between the two periods regarding the proportion of chemical eye exposures among total pediatric consultations (difference = 0.9%; 95% CI [-0.4, -2.1]; $p = .18$).

Ilyas et al. (2021) explored the impact of the lockdown in the United Kingdom on clinical practice in a pediatric population focused on **dental-facial trauma**. Between March 23th and June 14th, 2020, data from 102 patients under 16 years seen face to face in the King's College Hospital were collected. The majority of the injuries (58.8%) occurred within the home environment and 41.2% outside of the home. This occurrence is higher than worldwide prevalence trends, which previously have shown that 47% of traumatic dental injuries occurred within the home. Injuries seen include 56 (54.9%) dentoalveolar injuries, 37 (36.2%) lacerations, five (4.9) suspected facial fractures and four (3.9%) dog bites. Male and females were equally affected. The main causes were falls ($n = 47$, 46.1%) and bicycles/scooters ($n = 29$, 28.4%).

A Polish study (Olech et al., 2021) evaluated the impact of the pandemic on **distal radius fracture** (DRF) epidemiology in two large Trauma centers using medical data. Results show that the total number of patients under the age of 18 years hospitalized due to a DRF decreased by 3.8% ($p = .31$) during the pandemic. The number of children treated conservatively decreased statistically non-significant by 7.20% ($p = .376$), while the number of children that were treated surgically increased by 18.2% from 2019 to 2020.

Darling, Nowicka, Niazi and Pillai (2021) focused in their study the lockdown effects **on lower limb orthopedic trauma** of 67 pediatric patients (between 7 and 16 years old) in the UK. The authors retrospectively analyzed data from August 28th, 2019 to April 1st, 2021 (pre-lockdown, during the three lockdowns in the UK, interim periods and past-lockdown) considering the variations in the rate of referrals, types of fractures referred to the Manchester Foundation Trust (MFT), mechanism of injury, volume of operations performed and average wait times to undergo an operation. The referrals dropped over the lockdown periods from 0.84 to 0.68 (19%) per week and the average age from 11.1 to 6.9, with the number of males rising slightly. During lockdown three (23%) of the patients were managed non-operatively compared to 25 (46%) outside of the lockdowns. Fracture by anatomical location: lower leg fractures occurred in 21% during “no lockdown” vs. 69% during lockdown ($p = .0016$), ankle fractures decreased from 33.9 to 7.7%, although non-statistically significant, and no foot fractures occurred during the lockdowns compared to 7% outside of the lockdowns. Sporting injury was significantly lower during lockdown (8%) when compared to the non-lockdown period (37%) while other mechanism of injury road traffic accidents, trampoline etc. were not deemed significantly different. During the lockdowns the average wait time for operations dropped significantly. The rates of referrals during the lockdowns varied a lot, while the first and third were similarly to the pre-lockdown, the second lockdown showed a large drop in the rate of referrals. Also rate of operations varied across the three lockdown periods, with no operations during the first lockdown and a large increase the second interim period. Further, during the second lockdown every patient required an operation, during the third lockdown the rate reduced to less than a third of patients.

A retrospective, observational study by Charvillat et al. (2021) described the epidemiological impact of COVID-19 lockdown (between March 16th and May 11th, 2020) on **child burns** in a pediatric surgery department in France compared with previous five years (2016-2020) during the same calendar period. 37 children (0-17 years old, 19 boys, 18 girls) were included, 16 of them in 2020.

The data (sex and age, time interval between burn injury and first attendance, depth, burn area, injury site, type of incident, place of injury, skin graft) were a review of the patients' medical records. During an unstructured interview with the parents, they recorded data on child's reactions to trauma or isolation. In the COVID-19 group the median age of the children treated was 1.5 years ($M = 4.19$). The patient's age and sex profiles were consistent with the epidemiological data for France. Burn injuries were more than twice as frequent in 2020 ($n = 16$) than in 2016 ($n = 7$) or 2017 ($n = 7$). The median time interval between the burn and first contact with the department was in 2020 four days (2019 $Md = 5$, 2018 $Md = 3$, 2017 = 7, 2016 = 3). Nine (56.25%) burn injuries were with a Total Body Surface Area (TBSA) <5% and seven (43.75%) with a TBSA 5-9%. Burns with a TBSA of 5-9% were more frequent during the lockdown (2020 $n = 7$, 44%; 2019, 2018 = 0%; 2017 $n = 3$, 43%; 2016 $n = 2$, 29%). All the burn injuries during the lockdown occurred at home or in the immediate neighborhood. Lower limb burn injuries were more frequent in 2020 ($n = 5$, 21.7%, 2019 $n = 1$, 33.3%, 2018 $n = 2$ 33.3%). The major cause of burn injury was scalding. In the COVID-19-data, the injury mechanism, the burn depth, the TBSA and the requirement for a skin graft were similar to the before COVID-19 reference data.

A registry based cross-sectional study from Spain (Lopez Segui et al., 2021) analyzed **primary care visits** in 2019 (pre-pandemic) and 2020 (during the pandemic). Results for children and adolescents show a decrease in visits to primary care for patients in early childhood and infancy from 0 to 5 years old (-24.38% difference), and an increase in patients in adolescence (12 to 18 years old, 9.60% difference).

A cross-sectional study from Nicholson et al. (2020) examined **avoidance behavior** and the level of hesitancy in parents towards accessing pediatric healthcare during the COVID-19 pandemic. 1044 parents with children under the age of 16 living in Ireland participated. Data was collected from June 5th, 2020 to June 10th, 2020 during phase one of easing of restrictions. 34% of participants stated that their child required healthcare during the pandemic, of whom 22% ($n = 80$) decided against seeking healthcare. Of those that did, 42% had a face-to face consultation, 13% visited the emergency department (ED), and 39% had a remote consultation by phone or video. Almost half of participants were slightly concerned (46%) about the risk of their child contracting COVID-19, 32% were moderately concerned, while 9% felt their child was at high risk. Furthermore, 50% said their child would be somewhat affected if they contracted COVID-19, while 28% said they would be quite unwell and 10% thought their child would be very unwell. The majority (88.5%) utilized either official government or Health Service Executive (HSE) sources to inform themselves on accessing

pediatric healthcare, further 18% accessed information through friends and family on social media, while 17% turned to “experts” on social media. Fear of contracting COVID-19 (67.6%, $n = 706$) was the most reported concern related to pediatric health care access, while 30.2% ($n = 315$) stated that they were concerned the service would be busy at this time. Furthermore, 25.2% ($n = 263$) believed that services were needed more by others, while 24.4% ($n = 255$) feared they would be judged by healthcare professionals for attending. In total, 17.5% ($n = 183$) reported that they thought the public health advice issued by the government was to avoid health services. Additionally, 9.1% ($n = 95$) reported travel concerns such as a lack of access to a car and not wanting to use public transport, while 8.8% ($n = 92$) reported another reason. Hesitancy was associated with gender, stress and understanding governments advice. During early pandemic phases, delay and mitigation phase, females were twice as likely to report being much more hesitant ($RRR = 1.94$; CI [1.33, 2.82]). Parents who reported being much more hesitant were over twice as likely to report mild–moderate stress ($RRR = 2.31$; CI [1.54, 3.47]), while those with severe–extremely severe stress were over three times more likely ($RRR = 3.37$; CI [1.81, 6.27]). Parents who felt that the government advice was to stay away from health services were 1.7 times more likely to be much more hesitant ($RRR = 1.71$; CI [1.10, 2.67]). Similarly, in the reopening phase, respondents who reported having severe or extremely severe stress levels were over five times more likely to be much more hesitant ($RRR = 5.22$; CI [2.22, 12.29]), while those with mild or moderate stress levels were over three times more likely ($RRR = 3.10$; CI [1.56, 6.20]) compared with those with normal levels of stress, and there was a positive association between believing the government advice was to stay away and being much more hesitant in phase one ($RRR = 2.19$; CI [1.12, 4.29]).

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 (Md = 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.

In a descriptive study, Celik (2021) evaluated the problems and care burden of mothers with **handicapped children** during the pandemic. 216 mothers of handicapped children aged 0-18 years filled out an online questionnaire consisting of socio-demographic questions and the Burden

Interview Scale. 40.3% of mothers reported that during the pandemic their children could not benefit from the rehabilitation center and that the education of their child was negatively affected (71.3%). In addition, most mothers reported that their child did not receive special education (75.9%), that the care of child was interrupted (69.4%) and that health checks of their child were disrupted (64.4%). 75.9% of mothers stated, that they did not send their child to rehabilitation center. More than half of the mothers (56.0%) also reported that there was a negative change in family relationships during the pandemic period.

A cross-sectional online survey from Lithuania (Puteikis & Mameniškienė, 2021) aimed to capture changes in adult and pediatric neurologists' experiences when providing care for patients with **epilepsy** during the pandemic. 30 (28.85% of total sample) pediatric neurologists answered the survey (96.7% female, median 23 years in practice). Pediatric neurologists agreed that they managed to provide consultations of usual quality but for a smaller number of patients than usually. They rather disagreed that the conditions of some of their pediatric patients with epilepsy deteriorated because of delayed diagnostic tests. More than 80% of neurologists discussed the importance of AED regime during the pandemic and the importance of physical activity. 89% saw anxiety as a more frequent complaint during the pandemic, 60% disturbed sleep and 44% sadness. Less than 17% saw changes in seizure frequency in their pediatric patients due to COVID-19. In summary, the study report difficulties providing epilepsy care to the routine extent during the COVID-19 pandemic.

A retrospective, cross-sectional single center review from Festa et al. (2021) analyzed the number of **foreign body ingestions** cases during COVID-19. The data was collected retrospectively, the authors compared cases from March to September 2020 with cases from the same period the year prior. Children's age was between 10 months and 14 years. There was an increase in the foreign body ingestion during COVID-19 (2020: 10 cases vs. 2021: 25 cases). The ingestion of button batteries was most frequent (10 cases), followed by magnets (6 cases) and coins (3 cases). The cases of button batteries ($p = .04$) and magnets ($p = .04$) increased significantly during COVID-19.

Hogg, Hampton, Street, et al. (2021) compared the incident rate of the **Bell's palsy** also known as idiopathic facial nerve palsy in the periods before COVID (from February 14th to June 24th, 2019) and during covid (from February 14th to June 24th, 2020). This prospective study was conducted of patients aged under 16 years presenting with acute onset unilateral facial weakness of unknown aetiology (Bell's palsy) to the pediatric otorhinolaryngology unit in the UK. There was a significant

increase in incidents rates between 2019 and 2020 with three per 22 531 accident and emergency department patients in 2019 compared with 19 per 13 642 in 2020 ($p < .0001$). Of the seven SARS-CoV-2 antibody-test available in the 19 patients, all were negative. ENT colleagues at other centers (both nationally and internationally) have been asked if they have noticed an increase in the incidence (new presentations) of idiopathic facial nerve weakness in children aged under 16 from 15 centers, 4 confirmed the increased number of Bell's palsy, the estimated rate was the double of the expected number of cases in the UK, Colombia and of one unknown location.

A brief report from a multicenter retrospective study reviewed medical records of all children admitted with a final diagnosis of **bronchiolitis** to two pediatric children's hospitals in Italy and compared numbers of hospital admissions between the 2020/2021 winter season and the two previous ones. Results show that only eight patients were hospitalized for bronchiolitis in 2020-2021, compared to 148 in 2019-2020 and 140 in 2018-2019. None of the neonates or infants needed intensive care in 2020-2021. The eight patients in 2020-2021 spent a cumulative 32 days on the pediatric ward, which was significantly lower than the cumulative stays for admitted children in the previous years: 891 days in 2019-2020 and 754 days in 2018-2019. In addition, 17 (11%) of the patients in 2019-2020 and 15 (11%) in 2018-2019 were admitted to intensive care, where they spent a total of 132 days and 81 days respectively. In summary, the study shows a decrease in hospitalizations and intensive care admissions for bronchiolitis in the winter season 2020-2021, which can be related to the social distancing measures established to decrease the spread of COVID-19 (Risso et al., 2021).

A study from the Netherlands (Ragamin et al., 2021) investigated the impact of the pandemic on the care for children with **atopic dermatitis**. Outpatient records with total number and types of consultations during the first COVID-19 wave were compared with the corresponding months the two years before. Additionally, 144 caretakers of children answered an online questionnaire on clinical and psychological symptoms, and satisfaction with care. Results demonstrate an increase of 30.8% in the number of consultations compared to 2019 and 54.5% compared to 2018: during the first wave of COVID-19 a total of 913 consultations were conducted, compared to 6987 and 591 consultations in 2019 and 2018. The proportion of remote consultations was much higher (56.2%, $n = 513$ in 2020, $p < .000$), compared to 2019 (14.0%, $n = 98$) and 2018 (12.7%, $n = 75$). Caretakers were significantly more satisfied with care during face-to-face consultations than remote consultations ($p < .000$). Specifically, caretakers who believed that their child was more vulnerable for COVID-19 were significantly ($p = .026$) less satisfied with remote consultation (77.0; 95% CI

[70.2, -84.8]) compared to a face-to-face consultation (88.0; 95% CI [83.2, -93.4]). Caretakers of children who received remote consultations were significantly less satisfied with the emotional support scale of the PSQ ($p = .039$) and on the overall satisfaction scale ($p = .026$).

A retrospective registry cohort study from Sweden (Melander et al., 2021) analyzed pediatric **surgical and anesthetic services** during the first wave of the COVID-19. They focused on data of patients which were younger than 18 years and treated in 2019 and 2020.

There was a procedures reduction of 39.0% (2020: 10 991 vs. 2019: 18 006 > 7015 fewer cases) during the first wave (April). Elective cases were decreased by 53.7% (6819 fewer cases, $p < .001$). During the second week of April, there was the highest reduction in elective cases with 72.8%. With 86.7%, the ENT/maxillofacial surgery has been the most affected. The pediatric surgical and anesthesia capacity recovered by the end of June 2020 to near-normal levels.

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 ischemic 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 29th, 2020) compared with the period before their introduction (defined as Jan 1st, 2017 to March 7th, 2020), with data excluded for an adjustment-to-restrictions period (March 8th to 28th). 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 ischemic 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).

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 frequency of visits but non-significant (Vogel et al., 2021).

An increase of social care 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 1st to June 30th, 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 Finish 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 1st to October 31st, 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 SARS-CoV-2 to play a role, however the authors imply indirect effects of the pandemic for example delayed diagnosis.

A study in the South of France (Davin-Casalena B et al., 2021) resorted to regional insurance data to investigate health care utilization in primary care. It indicates that the initial stage of the lockdown was characterized by peak provisioning for drugs (no differentiation by age), whereas vaccination strongly declined. Vaccination of preventable childhood diseases dropped by 5% in under one - year-olds (900 Children), by 39% in under five-year old (4100 children) and Human Papiloma virus vaccination by 54% in 10 -14-year-olds (1200 girls). While vaccination numbers increased again after the lockdown, there is no evidence of a catch-up vaccination.

Polwiartek et al. (2021) measured, the effect of the Corona-Pandemic on the rate of pediatric infection-related hospitalization. A retrospective cohort design was used and included all Danish children < 18 years. Comparing the 2020 to the 2018/2019 study period prior to nationwide lockdown, a decline (36%) in infection-related hospitalizations (12.68, 95% CI [12.22, 13.16]) vs. 15.49 (95% CI [15.12, 15.86]) per 1000 person years) was observed. Respiratory infections were the most frequent cause of hospitalization, with respiratory syncytial virus (RSV [2018 = 31.27, RSV 23.7%; 2019 = 2712. RSV 19.0%; 2020 = 2560, RSV 18.5%]) being the most frequent causal agent. Further, incidence rate ration (IRR) decreased, especially during the lockdown period beginning March 12, 2020 (week 11: 0.64; 95% CI [0.55, 0.75]; week 12: 0.26; 95% CI [0.21, 0.33]; week 13: 0.13; 95% CI [0.10, 0.19]).

Paulauskaite et al. (2021) report the experience of parents with children with moderate to severe developmental disorders during the lockdown and post-lockdown. Disruption in accessing medical care for their child for both COVID-19 (67%) and non-COVID-19-related health problems was reported frequently (62.5%).

Camporesi et al. (2021) conducted a single-center longitudinal study reviewing the clinical charts of patients undergoing surgery between May 16th and September 30th 2020 and the same period surgeries in 2019. The patient's mean age was 5.5 years (IQR 0–13.5 years) in 2020, and 6.5 years (IQR range 0–20 years) in 2019. From May 16th to September 30th, 2020, a total number of 820

pediatric surgeries took place, compared to a total number of 1075 in the previous year. The data indicate a reduction in the percentage of elective cases and an increase in urgent procedures: In 2020, elective cases made up 65.6% and urgent cases 34.3% of the total cases compared to 80.3% and 19.6% during the same period in 2019. Regarding the urgent procedures, a significant difference was found in the distribution of the type of surgery ($\text{Chi}^2 p < .001$). Furthermore, a significant increase in the number of appendectomies ($p = .004$), burns ($p < .001$) and significant decrease in surgical sutures ($p = .002$) was found.

Campagnoli et al. (2021) examined the changes in numbers and reasons for ENT consultations in an emergency department (ED) in Italy during COVID-19 pandemic (1st March to 31st May 2020) and compared it with data from the previous year (1st March to 31st May 2019).

Results show a decrease in ED visits during the COVID-19 pandemic of 71.37% from 3653 to 1046 in pediatrics. Moreover, the number of ears, nose and throat (ENT) consults also decreased by 45.1% from 51 to 28 pediatric patients ($p < .01$). More specifically, the number of referrals for foreign bodies increased about 25% from 12 to 15 ($p < .01$), as did the amount of tonsillitis during COVID-19 compared to the previous year ($p = .34$). Furthermore, a reduction in the numbers of consults for otologic pathology (-90.8% ; $p = .045$), epistaxis (-80% ; $p = .196$), and nasal bone fracture (-70% ; $p = .36$) compared to the pre-pandemic time was observed.

Sheath et al. (2021) assessed the impact of the COVID-19 pandemic on the presentation and management of pediatric appendicitis using data from 75 consecutive pediatric patients admitted with right iliac fossa pain (RIF) to a hospital in the UK from 1st March 2020 until 30th June 2020 (COVID-19). While overall presentation of cases with specific or unspecific abdominal pain was lower. 97 patients were admitted from March 1st, 2019 until June 30th, 2019 (Control). Results show, that during the COVID-19 pandemic, the proportion of patients diagnosed with appendicitis was significantly higher (24% vs. 10%, $p = .03$). Furthermore, during the pandemic, the patients were admitted later to the hospital (3 days vs. 1 day, $p < .01$) with higher inflammatory markers (white cell count 15.8 vs. 13.2 $\times 10^9$ cells per liter, $p = .02$; C-reactive protein 53 vs. 27 mg/L, $p = .04$). During the pandemic, 94% of patients underwent surgery within 1 day of admission vs. 70% in the control group, $p = .13$).

Zampieri et al. (2021) investigated appendectomies performed between March–April of the years 2014 to 2020. A total of 155 patients aged 0 to 18 were included into the study. The results show no significant differences in age ($p > .05$), but significant differences in sex (male > female during

quarantine, $p < .05$) and in severity of appendicitis ($>$ severe manifestations, $p < .05$). Case numbers were stable across time, with a reduction found in March.

In a Turkish pulmonary polyclinic at a tertiary hospital outpatient visits in 2020 compared with 2019 decreased by 42.2%; and other laboratory procedures decreased after the pandemic started. Largest decrease was seen during the lockdown, but visits did not reach pre-pandemic values, and for spirometry which decreased by 87.2% (Buyuksahin et al., 2021).

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 ± 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 ± 0.2 ; post: 98.4 ± 0.5 ; surgical mask, pre: 98.4 ± 1.1 ; post: 96.0 ± 1.8 , $p < .001$) and an increase in heart rate (no surgical mask, pre: 71.4 ± 14.6 ; post: 77.7 ± 18.2 ; surgical mask, pre: 78.6 ± 9.4 ; post: 89.3 ± 11.2 , $p < .001$).

Impact on diagnostics/treatment

An Italian study from Pasca et. al. (2021) evaluated the impact of the COVID-19 pandemic in 23 pediatric patients with **epilepsy**, divided into two groups: group 1 representing patients with neurocognitive comorbidities and group 2 representing internalizing problems. The patients' parents were contacted between April and May 2020 (Child Behaviour Check List, Parenting Stress Questionnaire, phone calls). 43% voiced concerns for therapy monitoring at the time of lockdown and 30% worries regarding altered contact with the referring medical team out of four patients undergoing rehabilitation at t0 none was able to continue that therapy at t1, and of seven patients undergoing psychotherapy at t0 only three were able to continue the treatment at t1" The Child Behavior Checklist (CBCL) yielded differences about external problems and aggressive behavior. Total external problems generally increased at t1 in group 1 compared with group 2 with a positive,

albeit non-statistically significant trend ($p = .085$), and aggressive behavior worsened significantly in group 1 compared with group 2 at t1 ($p = .002$), while group 2 improved.

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).

A pulmonology policlinic at a tertiary Turkish hospital following mainly children with cystic fibrosis (CF), **primary ciliary dyskinesia (PCD)**, interstitial lung diseases (ILD), recurrent pneumonia, pleural effusion, tracheostomy, non-CF bronchiectasis, sleep disorders, difficult-to treat asthma and immune deficiency observed a drop of outpatient visits in 2020 by 42.2% compared with 2019. The largest decrease was seen during the lockdown, but visits did not reach pre-pandemic values. All laboratory procedures considerably decreased after the pandemic started due to decreased patients and recommendations by medical societies due to aerosol production in diagnostic procedures. Largest decrease was found for spirometry which decreased by 87.2% (Buyuksahin et al., 2021).

A Turkish Study found significant worsening in the functional dimensions (Functional Independence Measure for Children (WeeFIM)) and pain status (visual analog scale, 5.4% pre-lockdown vs. 26.4% after lockdown) of the children with **cerebral palsy** who were followed up at a university hospital pediatric rehabilitation unit between July to September 2020. The functional dimensions, self-care and mobility, but not cognition was significantly reduced ($p < .01$) and a quarter did not continue home exercises due to pain. Half of the children who were administered botulinus toxin rescheduled their appointment due to the pandemic. (Karatekin 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 ($M_{age} = 12.8$ 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).

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 in Turkey. 75 patients of a Children's Hospital with a median age of 12 years filled out a cross-sectional online survey between July 1st, 2020 to October 1st, 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%).

Ferraro et al. analyzed the maintenance therapy and asthma control level in 92 **asthmatic children** (72.8% male; M_{age} : 12 (± 3)) in Italy (Ferraro et al., 2021). Compared to 2019, in 2020 more children changed their maintenance therapy (14/92 [15.2%] vs. 35/92 [38%]; $p < .001$). There was a significant increase in both of children who increased (2019: 2/92 children [2.2%] vs. 2020: 10/92 children [10.9%]; $p = .033$) and children who reduced (2019: 12/92 [13%] vs. 2020: 25/92 children [27.2%]; $p = .026$); their maintenance therapy. As asthma control levels improved in the whole sample, also in children with severe asthma treated by Omalizumab, children and their parents seem to have managed the maintenance therapy well.

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 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). This reduction in access or attendance is supported by other studies but varied greatly: Cozzi et al. (Italy) report a decrease in visits by 77.5% (Cozzi et al., 2020), Liguoro et al. (2021) by 73% (Italy), Molina-Gutiérrez et al. (Spain) by 65.4% (Molina Gutiérrez et al., 2020), Bailhache et al. by 60% in France (2021), and Dopfer et al. by 63.8% compared to the same period of 2019, which confirms the effect of lockdown. Some studies focus on diagnose specific impact or differentiate diagnoses.

Palladino et al. (2020) investigated prevalence of admissions to the emergency department for **epileptic seizures** from March 9th until May 4th, 2020 compared with the same time period of the previous year. Of the total 3968 accesses to the emergency department, 61 of them (1.5%; 95% CI [0.012, 0.019]) for critical events, 57 (1.4%; 95% CI [0.011, 0.018]) for seizures and 4 (0.1%; 95% CI [0.0005, 0.0034]) for non-epileptic paroxysmal events. In the same period in 2019 16,923 admissions in ED were recorded, 40 (0.24%) for critical events (1/40 patients had non-epileptic paroxysmal event). Excluding surgical (829) and orthopedic (553) accesses, and non-urgent (426) patients, the prevalence of seizures was 2.6% (95% CI [0.020, 0.034]) in 2020 and 0.23% in 2019 ($p < .0001$) and incidence of seizures was 0.94% (95% CI [0.006, 0.014]), compared to 0.13% ($p < .0001$).

Davico et al. (2020) studied trends in emergency department (ED) access in two university hospitals in Italy for **seizure-related reasons**. All ED accesses of children younger than 14 years between 6th January 2020 and 21th April 2020 were examined and compared with the corresponding period in 2019. There was a reduction of 72% in all pediatric ED accesses with a 38 % decrease in seizure-related accesses during the COVID-19 lockdown period from 23th February to 21th April 2020, lockdown period, compared to the same period in 2019 ($n = 3'395$ vs. $n = 12'128$), with a decrease of 38% in seizure-related hospital emergency visits ($n = 41$ vs. $n = 66$). Furthermore, a poisson regression yielded a 59% reduction in seizure related accesses due to the lockdown compared to the corresponding period in 2019.

Dopfer et al. (2020) conducted a monocentric, retrospective analysis of 5424 pediatric emergency department visits between 1st January and 19th April 2019 and 2020, and compared healthcare utilization in the respective calendar weeks 12–15 from in a German pediatric ED. All medical and demographic data was retrieved from routine electronic clinical records, the mean age of all patients was 7.1 years (\pm standard error mean (SEM) = 0.1 years). In the calendar weeks 12-15 in 2020 (four weeks into the lockdown) case numbers decreased by 63.8% compared to the same period in the previous year (mean daily visits $26.8 \pm$ SEM 1.5 in 2019 vs. $9.7 \pm$ SEM 1 in 2020, $p < .005$). A decrease in pediatric emergency healthcare utilization was observed for both communicable and non-communicable diseases. There was a larger proportion of infants below the age of one year (daily mean of $16.6\% \pm$ SEM 1.4 in 2019 vs. $23.1\% \pm$ SEM 1.7 in 2020, $p < .01$) and of patients requiring hospitalization ($M = 13.9\% \pm$ SEM 1.6 in 2019 vs. $26.6\% \pm$ SEM 3.3 in 2020, $p < .001$) during the pandemic, although the absolute numbers of daily hospitalizations of pediatric ED patients decreased significantly by 38.4%. The largest changes in absolute numbers were observed in patients with **neoplastic diseases** (5.6% in 2019 vs. 14.9% in 2020), with pathologies of the perinatal period (22.5% in 2019 vs. 8.1% in 2020) and with diseases of the heart and circulatory system (5.6% in 2019 vs. 0% in 2020).

A descriptive and retrospective study from Turkey (Akkoç et al., 2021) compared the burn cases in a University hospital burn unit between 16th March and 30th May of 2018, 2019, and 2020. In 2020 the hospital treated a total of 49 **burn injuries**, about half compared to previous years (93 in 2018 / 88 in 2019). In terms of type of burns, intervention, and length of hospital stay there was a significant differences between 2020 and 2018 and 2019 ($p < .001$). Most cases occurred in 1 and 5-year-olds (2020: 67.3%; 2019: 38.6%; 2018: 59.1%).

Kuitunen et al. investigated **pediatric intoxication** in Finland. Among the 5820 ED visits in 2020 and the 23,241 in 2017–2019 were 50 intoxicated patients in 2020 and 124 in 2017–2019. A higher proportion of ED visits were due intoxication in 2020 (0.8% vs 0.5%, $p = .01$) and, overall, the incidence of pediatric intoxications was higher: 65 per 10 000 children in 2020 and 54 per 10 000 in 2017–2019 (IRR 1.20; CI [0.87, 1.68]). While during the lockdown the incidence was lower compared to reference years (IRR 0.50; CI [0.17, 1.44]), before the lockdown the incidence of intoxicated patients was higher (IRR 1.65; CI [0.79, 3.44]) and afterwards. monthly peak incidence (12 per 10,000) were recorded in July 2020 (IRR 2.45; CI [1.01, 5.92]) and November, 9 per 10,000 (IRR 4.45; CI [1.33, 13.2]). Fewer patients needed inpatient admission in 2020 and alcohol-related

injuries were not more frequent. The patient age did not differ between 2020 and the reference years, and gender distribution was similar (Kuitunen, 2021).

A study from Portugal (Paiva et al., 2021) comparing data from March 30th to June 30th, 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%, $p < .001$).

Rhedin et al. (2021) assessed the numbers of emergency visits as well as visits for lower **respiratory tract infections, gastroenteritis and urinary tract infections** at the two pediatric hospitals in Stockholm, Sweden, during 2020. Comparisons with the two previous years yield a decrease in the numbers of pediatric emergency visits in 2020 (especially for the time from March to June) as compared to the years 2018–2019. This reduction is associated with the announcement of community transmission of SARS-Cov-2 and hygiene recommendations from the Public Health Agency of Sweden ($p < .001$). This trend of decreased visits was also observed for visits for lower respiratory tract infections (cumulative incidence 0.24% in 2020 versus 0.57%, $p < .001$) and gastroenteritis (cumulative incidence 0.26% in 2020 versus 0.87%, $p < .001$). However, the number of visits for urinary tract infections slightly increased in 2020 compared to the previous two years (0.22% versus 0.20%, $p = .01$).

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.

Raucci et al. (2021) collected data from the hospitals Healthcare Emergency Information System (HEIS) and the Hospital Information System (HIS) from two different pediatric centers (in Rome and Palidoro) for the period between the 21st of February and the 30th of April 2020 (pandemic period) and the same period of 2019 (pre-pandemic period). From 21st February to 30th April 2020, **ED visits** decreased sharply by 56% in Rome and 62% in Palidoro center. In both centers the decrease in the mean daily numbers of ED visits was most evident for Diseases of Respiratory System (–63% in Rome; –60% in Palidoro and for Diseases of the Nervous System and Sense Organs (–71% in Rome; –77% in Palidoro). According to the priority of consultation (high/intermediate and low/non-urgent conditions), a reduction in both groups was observed in Rome, more evident in postponable non urgent group (–32% vs. –63% of reduction), whereas at the center in Palidoro high/intermediate priority consultations slightly increased (+13% vs. –69%). The relative frequency of hospitalizations increased, going from 14.2% to 24.4% in Rome and from 6.4% to 10.3% in Palidoro. Regarding the absolute daily numbers, there was a decrease of urgent hospitalizations from 1788 during the pre-pandemic period to 1360 during the pandemic period in Rome (24% reduction), and from 418 inpatient stays during pre-pandemic period to 359 during the pandemic period (15% reduction) in Palidoro.

Area-based cohort study on pediatric attendances (0–15 yrs.) from Rusconi et al. (2021) investigated hospital admission in Tuscany, Italy, in February-May 2020, and the corresponding periods in 2018–19. ED attendance fell sharply (–62%) in 2020 vs 2018–19. As for cases studied (455 in 2020 and 1161 in 2018–19), they documented a **delay in arrival** to the ED in 2020 versus 2018–19 for several diagnoses: gastroenteritis, sepsis, wounds, burns and infections overall. Time to presentation over 90th centile was also higher in 2020 (*OR* = 1.44; 95% CI [1.00, 2.06]), as were paediatricians' judgements of a late arrival (18.9% of cases in 2020 vs. 13.4% in 2018–19; *OR* = 1.58; 95% CI [1.14, 2.19])

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 (Polcwiartek et al., 2021; Van Brusselen et al., 2021), 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 multicenter study from Kruizinga et al. (2021) investigated the effects of lockdown on pediatric care in the Netherlands summarizing **emergency department (ED) visits** and hospital admission data of 8 general hospitals in the Netherlands between January 2016 and June 2020. Between January 2016 and June 2020 a total of 126'198 ED visits and 47'648 admissions were registered in the 8 participating centers. There was a statistically significant reduction in the ED visits and admissions from February 2020 onwards. The largest estimated reduction was in April 2020, a month after the lockdown, 59% (95% CI [51%, 68%], $p < .001$) for ED visits and 57% (95% CI [47%, 67%], $p < .001$) for admissions. **Communicable infections** (ED visits (76%, 95% CI [64%, 88%], $p < .001$)) and admissions (77%, 95% CI [63, 92%], $p < .001$) and infection related diagnoses (ED visits of 71% (95% CI [54%, 89%], $p < .001$) and admissions of 78% (95%, CI [53%, 103%], $p < .001$). showed highest reductions, while noncommunicable infections showed no significant effect. As similar for diagnoses assumed to be related to infections, an identical reduction was observed, with a reduction of Noninfectious diseases yielded the largest drop in April ED visits (36% reduction (95% CI [26%, 46%], $p < .001$) and in March for admissions: 33% (95% CI [20%, 46%], $p < .001$).

A retrospective observational cohort study of all children (0–15 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 10th, 2020 to April 30th, 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] compared to 2019 (66.5%, 95% CI [62.4, 70.4]). 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 (≤ 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.

Conlon et al. (2021) conducted a qualitative study to assess the impact of COVID-10 on child health and the **provision of care in pediatric emergency departments (ED)**. Between August and October 2020, a total of fifteen semi-structured interviews were conducted with frontline staff (emergency medicine clinicians ($n = 5$), nursing managerial staff ($n = 6$), medical social workers ($n = 2$) and nursing staff ($n = 2$). Seven main themes were identified: 1) Declines, delays and avoidance: attendances dropped, delayed presentations to the ED (->led to prolonged treatment or worsened outcomes for children), less presentations of children with complex needs and chronic conditions; 2) Parental concerns: contagion fear and messaging, high levels of reluctance to attend the ED, stay at home due to infection risk; 3) Psychosocial impact on children; impact on children's mental health and wellbeing, rise in presentations relating to psychosocial issues 4) Disrupted access to community healthcare: difficulty in accessing GP care (no appointments 5) Re-configuring the ED to create capacity and 6) Quality and safety in care delivery processes: significant and rapid operational changes in EDs in March 2020; positive acceptance towards the re-configuring of the ED both spatially and operationally from clinicians; stress among staff and challenging situation for leaders; 7) Psychological challenges for staff: anxiety of contracting COVID-19 and transmitting.

Indolfi et al. (2021) investigated the **preparedness for the COVID-19 pandemic** among a European network of 8 children's tertiary hospitals with a cross-sectional web-based survey administered in May 2020. The study identified significant reductions of hospital activities in all 8 European hospitals regarding number of outpatient visits, emergency department attendances, ICU and non-ICU inpatient admissions in February 1st – April 30th, 2020 compared with the same period of 2019. The most relevant reduction rate was observed in the emergency departments (41.7%) followed by outpatient visits (35.7%), intensive care unit and non-intensive care unit inpatient admissions (16.4 and 13%, respectively). Telemedicine and telehealth services were used before the SARS-CoV-2 pandemic by three (3/8) hospitals and by all the hospitals during the pandemic.

Impact on self-injury

The from Steinhoff et al. (2021) analyzed the risk factors for self-injury and domestic physical Swiss z-proso study violence perpetration during COVID-19. The authors used data from a prospective longitudinal community study with a sample of 786 young adults (22 years old). 'Pre-pandemic' data from one assessment in 2018 and 'during-pandemic' data from 4 assessments (April, May,

September) were compared. In 2018, the participants completed interview surveys at university, in 2020 the interviews were conducted online. 9% of the participants reported any self-injury at one or more assessments between April and September 2020. 16% of the participants living with someone reported domestic physical violence. 3% reported both. Domestic violence perpetration increased among males (5% in April to 10% in late May ($p = .014$), but not females. The risk of self-injury was higher among those living alone compared to those cohabiting with parents or peers (Unadjusted coefficients: β : 0.20, 95% CI [0.08, 0.31], $p = .001$ resp. β : 0.14, 95% CI [-0.00, 0.28], $p = .056$). Low SES ($OR = 0.23$, 95% CI [0.07, 0.39]) and parental migration background ($OR = 0.16$, 95% CI [0.01, 0.30]) were associated with a higher risk of perpetrating domestic physical violence during the pandemic.

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.

A retrospective cohort study from Ougrin et al. (2021) analyzed the self-harm behavior of children and adolescents during lockdown in 10 different countries. The analysis included a total of 2073 acute hospital presentations by 1795 <18 years old children and adolescents. Data was compared from t1: March–April 2020 ($n = 834$) and t2: March–April 2019 ($n = 1239$). In 2020, there were significant more hospital visits due to self-harm than in 2019 ($p = 0,009$; $OR = 1.33$, 95% CI [1.07, 1.64]). Children and adolescents with a previous history of self-harm showed an increase in 2020 (from 29 to 36%, and from 63 to 71%). Among patients with an additional disorder the emotional disorders increased significant with an estimated odds ratio of 1.58 (95% CI [1.06, 2.36]; $p = .025$).

Physical, sexual abuse / domestic violence

Baier and Kamenowski (2020) from the Zurich University of Applied Sciences did a cross-sectional study on adolescents' lockdown experience, in particular regarding school closures, in the canton of Zurich 1103 adolescents aged between 12 and 20 years ($M_{age} = 15.5$ years) years filled out the online questionnaire from April 23th to May 19th, 2020. Information on the before the lockdown

behaviors and activities was reported retrospectively. The proportion of participants reporting high levels of affection from the parents increased from 53.0% to 66.7% ($p < .001$), furthermore, there was a slight decrease in the percentage of respondents who experienced parental violence (from 10.2 to 8.8%; $p < .05$)

Jenkel and Güneş (2020) investigated the effect of the COVID-19-pandemic on children and adolescents in stationary child and youth welfare. 238 Participants, mostly age 14–18 years old ($M_{\text{age}} = 18$, 48.3% female), answered an online survey between the 1st of May and 8th of June 2020. The majority stated they would rather be at home. Adolescents in stationary care experienced an increased isolation because of the restriction on visits of family and friends. 58.3% saw their family less than usual, almost a third didn't get any visits, and 10% didn't have any contact (in person or via phone, etc.). A positive impact of the restrictions was experiencing less domestic violence. Up to 40% experienced a decrease in mental wellbeing. A third was feeling depressed since the start of the pandemic. A small percentage, 16%, indicated an improvement in mental wellbeing. Especially kids with prior difficulties suffered more. The same is true for physical wellbeing. 30% experienced worsening.

A helpline from Pro Juventute, "Beratung 147.ch", registered an increase of consultations on the topic of "loneliness" by 37% and regarding "losing friends" by 93% in 2020 compared to the previous year. With the start of the second wave from October – December 2020, the number of consultations regarding "mental disorders" increased by 40%. Furthermore, in 2020 29% more sought help in an acute crisis situation compared to the previous year. In general, young people sought more advice about family conflicts and domestic violence throughout the year. During the first lockdown, inquiries about "conflicts with parents" (+60%), "conflicts with siblings" (+100%), and "domestic violence" (+70%) increased sharply (Meier, 2021).

A qualitative study of Huscsava et al. (2021) investigated the switch from face-to-face to teletherapy on young patients with a psychological disorder in Austria. The participants ($N = 30$) were on average 16.21 years old ($SD = 1.567$; Range from 12 to 18) and mainly female (87%), and almost all lived at home (90%). The data was collected at some point in the lockdown (date is unclear). Interviews were conducted for this purpose. Interesting data were collected in the semi-structured interviews: symptoms, substance use, social context and perception of COVID-19-associated measures. The main results were the following: 20% reported childhood adversities. Some patients

reported an increase (3%) and others a decrease (10%) in physical violence in the household within the first two months of lockdown. Most of the patients who have experience which sexual violence, reported a decrease (80%) during the crisis, while 20% mentioned no change in this time. 50% of the participants who had been victims of neglect in the past reported an increase in neglect during the lockdown, while 40% reported a decrease of neglect during that time. There were also interesting findings for symptoms. Anxiety symptoms became worse for 43% of the patients., while 10% noted an improvement. A decrease of mood was reported for 73% of the patients, while 17% perceived an improvement. Patients reported an increase in tense (40%), non-suicidal injuries (45%) and obsessive compulsory behavior (80%). Alcohol (7%) and tobacco (17%) consumption was reported from participants. Three themes were found in the qualitative analyses: changes in the structure of thoughts, feelings of isolation and a reduction in school-associated stress. Rumination seems to be a factor of deterioration of the psychosocial functioning level.

A study from Augusti et al. (2021) aimed to establish rates of child abuse and family conflict 2020 in Norway with a web- survey with self-reported exposure to violence and abuse experiences of 1944 youths (13–16 years old, 50.3% girls, 44.3% boys)) at two time points, pre-COVID (January 2019) and during the lockdown of the pandemic (June 2020). The most frequent experience was with psychological abuse, followed by witnessing domestic violence. Most of the psychological and physical abuse took place at home (83.7% and 78%, respectively). 39.9 % experienced sexual abuse within their home and 60.4 % happened outside the adolescent's home. Most adolescents reported that this was not their first encounter with violence and abuse. Approximately half of the adolescents experienced online sexual abuse during COVID-19 first lockdown (47.4%) and reported having experienced this for the first time. Family conflict did not increase during the lockdown. Perceived family conflict was only marginally associated with the experience of physical violence (p .001) and modestly associated with psychological abuse (p .001) and domestic violence (p .001). Girls were significantly more exposed to all forms of abuse, except physical abuse. Children living in families with financial hardship and in which parents were perceived as having mental health or alcohol misuse problems reported significantly higher rates of abuse, than children not facing such adversities at home. Prior victimization was the factor most strongly associated with COVID-19 related violence and abuse experiences OR 3.84 (95% CI [2.85,5.29]).

In a mixed-methods nested cross-sectional study from Tierolf et. al. (2021) from the Netherlands 159 families already known to social services were recruited before and 87 families during the covid19 lockdown to investigate domestic violence in families during the corona crisis. The data

were collected within a longitudinal study, about 1450 families were followed for a year and a half after they had been reported to responsible institutions for suspected partner violence or child abuse. Two questionnaire-based studies and one interview-based study were performed between January and March 2020. The results show that violence does not seem to have increased during the covid crisis, children did not feel more insecure during the lockdown than before, for teenagers their emotional insecurity was significantly lower in all areas during the lockdown. Trauma symptoms and alcohol consumption also decreased in teenagers during the lockdown. But the teenagers still felt more unsafe and had more trauma symptoms than people of same age in the normal population. No significant difference in clinically traumatized children were found compared to the values of before the lockdown. Most families stated that stress was caused in the family due to the corona crisis.

An increase of cases was evidenced in a retrospective analysis of referrals from a hospital's children's social care (CSC) in the UK (1st April to 30th 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 20th, 2020 (first day of school closure) to July 19th 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 sources: hospitals reporting increased numbers of conspicuous injuries, which may be related to maltreatment; the youth welfare portal (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.

A Dutch study (Sari et al., 2021) recruited parents during the period of school and day care closure (April 17th to May 10th, 2020) and matched the sample (COVID-19 sample, $n = 206$) to a sample of parents from the Generation R Study ($n = 1030$). The COVID-19 sample had a higher score on the total harsh parenting scale ($p < .01$), a higher prevalence of the following item: "shook my child" ($p < .001$). Effect sizes of the pre- and post- pandemic differences in item scores were medium to large. The study suggests that parental tolerance for children's disobedience was lower and abusive parenting responses were more difficult to inhibit under the adverse circumstances of COVID-19.

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

Summary

Most children, adolescents, and young adults are **worried**. For example in Sweden about 80% of children and adolescents are commonly having worrisome thoughts with adolescents and young adults worrying about more differentiated problems (e.g., how the health care system will cope with the number of COVID-19 patients). During the lockdown, children from 6 to 18 years reported worries, whereby younger children (6 to 10 years) reported the greatest fears about Corona and the current situation and adolescents were more afraid of no longer having the same future opportunities. Compared to the year before the COVID-19 pandemic, adolescents experienced reduced levels of positive affect and increased levels of negative affect. 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. 15–34-year-olds also indicated that the fear of the future had become particularly important to them.

Generally, younger 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. Thereby, higher loneliness in adolescents was associated with higher scores on all mental health measures (emotional symptoms, conduct problems, hyperactivity-inattention, and psychological stress). Particularly those with general psychopathology symptoms reported increases in worries and anxiety. This was especially true for adolescents in stationary child and youth welfare who were more isolated and where almost 40% experienced a decrease in mental wellbeing. 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.

A very large number of studies focused on **psychological distress**, thereby building a substantial body of evidence. It is therefore well-established that the crisis situation had a great impact on the emotional state of children, adolescents, and young adults that is larger than the impact on the older generations. 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 **psychological distress, anxiety, depression, fatigue, tiredness, and general psychopathology** increased.

Children's engagement in "productive" activities such as school, homework and extracurricular activities decreased and "non-productive" time, including TV, passive screen time, social networks, and others increased. For instance, children watched approximately twice as much as before lockdown. Higher proportion of children (i.e., 30-40%) showed increases in negative outcomes such as conduct problems (29.4%), emotional problems (27.4%), and hyperactive behavior (39.5%) and depression, anxiety and loneliness were higher in adolescents and young adults in May and June 2020 than in pre-pandemic times. More than one third of children showed a high risk for COVID-19-related post-traumatic stress disturbances – independently of whether they have a psychiatric problem or not – and one third of adolescents were at risk for COVID-19-related acute stress disorder during the lockdown and females between 13 and 18 years seem to be more affected in their mental health than males. The negative impact of the lockdown on mental health was already evident after 8 to 10 days in children and adolescents with increased problems in rebellious behavior, rage control, and emotional regulation as well as anxiety and depression. For instance, with up to a third exceeding the cut-off levels for clinically relevant symptoms. 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 14–24-year-olds being the most affected at 29%. Between March 8th and 24th, 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. Similarly, a longitudinal study from Germany observed that the percentage of 11 to 17-year-olds who experienced lower health-related quality of life increased from 15% before COVID-19 to 40% during COVID-19, with girls and younger children being more affected. *As complementary evidence, the use of helplines increased by about 50%, youth workers perceived increasing frustration and anxiousness in children and adolescents and suicide was raised as a topic among young people more often than before the COVID-19 pandemic.*

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. A strong predictor of children's psychological symptoms is the situation of the family. Stress and instability, low education levels and socio-economic problems, small living spaces or a migration background were considered to increase mental health risks for children and adolescents. For instance, children from divorced families and families with a low income were more likely to be part of the 20% of children that were at risk for Post-Traumatic Stress Disorders. Further, children's and adolescents' executive functions, coping strategies, emotion regulation, social competencies, changes in mood and increased emotional reactivity represent a vulnerability factors, particularly for those who experience more stressors.

Regarding **schools**, impact of isolation, home learning and exam cancellation on mental health, an initial positive impact of the lockdown their mental health was found in adolescents between 14 and 18 years. However, home learning was experienced differently. For some of the students, it was stressful and difficult to maintain motivation for learning. For others, the greater opportunities for self-directed learning were enjoyable. Similarly, the experiences of 'returning to school', was rated positively as well as negatively.

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. Compared to the pre-pandemic period, the quality of mother-child interactions during feeding worsened during the lockdown and mothers rated children's emotional/behavioral functioning (e.g., withdrawn, anxious/depressed and aggressive as well as internalizing and externalizing behavior) as more maladaptive. Thereby, parental tolerance for children's disobedience was lower and parents of younger children who experienced high levels of stress were found to pay limited attention to their child, which was directly associated with more child emotion regulation problems. Distance schooling increased restlessness and aggressiveness in younger children and anxiety in older children.

Adolescents with current/past **eating disorders** reported significantly more difficulties in regulating their eating behavior and the reactivation of symptoms. During the lockdown, more than half of adolescent patients with eating disorder were positively screened for depression and depression has been found to be the most important predictor of eating disorder behavior. Of **children and adolescents with type 1 diabetes**, 8.69% showed signs of disordered eating behaviors, relative to 13.4% in controls. Studies on **alcohol consumption** are **not entirely conclusive**. Whereas more studies observed a reduction in alcohol consumption and that binge drinking, **hazardous drinking**, **the hazardous consumption of cannabis**, and **smoking cigarettes** or **e-cigarettes** did not increase or even decrease, 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”. A group where increases in daily smoking was observed were vocational and educational training students who had an increased risk of substance use. In Switzerland, a decrease in all categories of substance consumption was observed during the lockdown. While 46% of about 1'100 adolescents aged between 12 and 20 years drank alcohol before the lockdown, only 40% did so during the school closures. Similarly, the rate for cigarette use decreased from 14% to 11% and the one for other drugs from 14% to 10%. For **other drugs** such as ecstasy, amphetamines, nitrous oxide, Gamma Hydroxybutyrate (GHB) a decrease was found during spring 2020 with the exception of Mephedron (3-MMC/4-MMC) where increases relative to “pre-corona” rates were observed. Fewer social occasions were the most important reason for the decreases, followed by **physical and mental health**. With respect to cannabis users, the levels of apathy and anhedonia had increased since the onset of the COVID-19 lockdown, and that this increase was larger in dependent compared to non-dependent cannabis users.

The effects for children and adolescents with **Attention Deficit Hyperactivity Disorder (ADHD)**, **Autism Spectrum Disorder (ASD)**, **cystic fibrosis**, **primary ciliary dyskinesia**, and **asthma** as well as **multiple sclerosis** showed effects on well-being and social relations, however, there is a greater variance with respect to the direction of the early effects of the COVID-19 pandemic. While some benefitted from the reduction of external demands that cause stress (e.g., tightly organized school schedules for children with ADHD, social situations for children with ASD, **lower infectious exposure** in children with cystic fibrosis, or improved compliance to chest physiotherapy in children with primary ciliary dyskinesia, less external stressors such as social pressure in adolescents with somatic symptom disorder), others (e.g., children with **Pediatric Acute-Onset Neuropsychiatric Syndrome (PANDAS/PANS)**) experience decreases in their mental health and increases in their

anxiety levels as external support is reduced (e.g., local health services, school or private therapist) and an aggravation of symptoms such as repetitive movements or tics, cognitive difficulties, affective and thought problems and behavioral problems such as somatic complaints, excessive use of video games, opposition, hyperactivity, or aggressive/destructive behavior or compulsions in children with PANDAS/PANS. in children and adolescents with **Tourette syndrome**, about two-thirds showed a worsening of the overall clinical picture with tics, hyperactivity, rage attacks, obsessions/compulsions and anxiety. Regarding the effectiveness of measures to reduce the impact of the lockdown on adaptive functioning in children, children with Autism Spectrum Disorder whose parents underwent an online parental support or training during lockdown had a significant improvement in the Practical Adaptive Domain and in communication and socialization compared to the individuals with ASD whose parents did not receive such support or training.

Over the course of the pandemic, **younger children** were more affected and showed higher percentages of incremented oppositional defiant behaviors, a gradual loss of social contact with peers, increased irritability increased dependence on adults behaviors, increased repetitive body movements, and increased death-related anxieties. **Prepubescents** showed increased use of electronic devices increased regressive behaviors and increased attention problems. **The lockdown has increased the stress of parents with children with neurodevelopmental disabilities (NDD)** as the lockdown was associated with a decrease of therapeutic/rehabilitation activities, which was found to be related to higher levels of children's externalizing behaviors.

Regarding **emotional difficulties** and **externalizing behaviors** such as hyperactivity/inattention, several studies observed increases during the lockdown. For instance, a study in Switzerland observed that between 40 and 70% of children between 4 and 17 years experienced emotional and physical difficulties. Similarly, children and young people with **neurodevelopmental disorders** showed higher levels of emotional symptoms and conduct problems and fewer prosocial behaviors during the lockdown. Factors that were associated with higher levels of symptoms were parental stress, anxiety, or depression and socioeconomic difficulties as well as having special education needs or neurodevelopmental disorders, being younger, being male and having a higher child distance learning workload. In children and adolescents with **neuropsychiatric disorders** aged 6-18 years, obsessive-compulsive, post-traumatic and thought problems increased. Financial hardship experienced by the families during lockdown were associated with increases in psychiatric symptoms. Regarding children and adolescents with **obsessive compulsive disorder (OCD)**,

OCD, depressive, and anxiety symptoms worsened during the COVID-19 crisis and thoughts about COVID-19 became an integral part of their OCD for about 15 percent. The worsening of the symptoms was most pronounced in younger members, in those with early age of onset, and with a family history of ADHD. Also children and adolescents with **Prader–Willi syndrome** were concerned about COVID-19 and showed increases in psychopathological symptoms during the lockdown such as temper outbursts, conflicts with other people and irritability, depressed mood, anxiety, social withdrawal, daytime sleepiness, desire to eat, obsessive-compulsive behavior, psychotic experiences, and suicidal thoughts.

For children with **cancer**, different outcomes have been observed. One study found that children's occupational performance, satisfaction and quality of life decreased significantly between April and September 2020 as well as their participation in neighborhood and community participation and participation in community living activities. Another study did neither find decreases in health-related quality of life nor in fatigue. Although 80% of children with **multiple sclerosis** (MS) aged 8–18 years thought that they have a higher risk and more severe symptoms compared to healthy individuals, they experienced similar anxiety levels than their parents and other patients. Thereby, higher anxiety scores were related to putting on more weight. Children and adolescents with **Inflammatory Bowel Disease** (IBD) expressed great fear to get infected by COVID-19 and adapted their behavior accordingly (e.g., they left the house less frequently than they did before COVID-19).

Children with **special needs** were found to have poorer mental health due to missing peers, missing other activities, and confusion about the situation. They were reported to be crying more, feeling more nervous than usual, getting more angry and feeling sadder during the lockdown. They also have more unhealthy habits, eat more than usual, are less physically active, overuse new technology and watch too much TV. Whereas children with **special educational needs and disabilities** (SEND) showed particularly increased anxiety and worries during and after the lockdown and they suffered particularly from the school closures, their typically developing siblings were also negatively affected by increased anxiety and worries. Also children with **specific learning disabilities** experienced more problems. However, some parents of children with special educational needs and disability reported mixed feelings about the education as some of the children were happier and more eager to study (less school-generated stress). In line with these findings on negative as well as positive effects, a longitudinal study from the UK also found a high stability of the psychological distress, life satisfaction, and child behavior before and during the lockdown in parents and children with intellectual disabilities. In general, SEND families felt a lack of

support and as contextual factors, single parenthood, living in an apartment and without a large garden, as well as being an only child were associated with more child problems during the lockdown. For children with **sickle cell disease**, more than one third reported significant clinical symptoms for state anxiety. Moreover, young **LGBTQ+** adults were emotionally affected and felt isolated.

Regarding the **utilization of mental health services** in 2021, the impact of COVID-19 on child and adolescent psychiatry (CAP) services in Europe has been examined in a survey from spring 2021. It showed an increase in the perceived impact of the pandemic on the mental health and psychopathology of children and adolescents dramatically from “medium” (> 50%) in 2020 to “strong” or “extreme” (80%) in 2021. For instance, about 40% of patients with various psychiatric disorders who were admitted to inpatient treatment stated an increased need for therapeutic support in response to the worsening symptoms during the pandemic with adolescents having higher values for symptoms of suicidality and self-harm than adults. Generally, the number of referrals or requests for assessment rose in 2021. Most impacted disorders were suicidal crises (83%), anxiety disorders (70%), eating disorders (64%) and major depressive episodes (61%). Heads of the CAP departments expressed strong concerns regarding the management of the long-term consequences of this crisis, especially regarding the provision of care in light of the perceived increase in referrals.

Regarding 2020, several large-scale studies from the **UK, France, and Denmark** observed that primary care contacts were 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. Similarly, the total number of psychiatric admissions to the emergency department was significantly reduced in March to June 2020 compared to the same period in the previous year, with a reduction in admission rates of about 50%. There were delayed presentations to the emergency department which led to prolonged treatment or worsened outcomes for children. Operational changes in emergency departments were swiftly made but added to the stress among staff and leaders. There was also evidence that contacts between health professionals and patients decreased from before the COVID-19 pandemic to during the pandemic such that patients treated for substance misuse, patients with intellectual disability, and patients with pervasive and specific developmental disorders had less weekly contacts. Although the frequency of primary care contacts recovered it did not attain pre-lockdown levels.

Regarding the capacities of the mental health care services and shift to telemedicine, a study by the European Society for Child and Adolescent Psychiatry (ESCAP) Research Academy reported that during the lockdown throughout Europe, closures or reductions in the number of treated patients were two-thirds in outpatient units and one-third for inpatient units. Also accessing the general physician care became more difficult as there were little or no appointments available during the lockdown. Many services adopted telemedicine despite its sparse use prior to the crisis. For instance, in a study from France, about half of the consultations in March and May 2020 and all consultation in April 2020 were teleconsultations although there were challenges with engagement (including technical difficulties) in remote/virtual psychological work as well as increased workloads due to both new referrals and current patients experiencing mental health difficulties as a result of COVID-19. A large study from the UK showed, however, that the use of remote consultation did not affect the level of prescribing of psychiatric medications.

Number of publications: 172

Results

Worries and social contacts

A study in Switzerland by Caviezel Schmitz and Krüger (2020) investigated the effects of the pandemic on emotional and physical changes in children and adolescents (Age range 2-17 years). 165 parents answered an online survey for their children ($N_{\text{children}} = 245$; $M_{\text{age}} = 7$ years old). They measured children's psychological distress using the Strengths and Difficulties Questionnaire (SDQ) at two different time points with two different groups (April 20th to May 10th, 2020 lockdown and May 11th to June 7th, 2020 lifting of restrictions). 40% of the children experienced some sort of difficulties. At both time points, 40% of the 4-8-year-old-children and 50% of the 9-14-year-old-children had at least light difficulties. 50% of the 15-17-year-old children had difficulties during the first period during the lockdown; this increased to 70% at the lifting of restrictions period. Most of the children worried little with children older than 9 years worrying more often than younger children. Particularly older children and adolescents did not look positive into the future during the second measurement period.

Jenkel, Güneş and Schmid (2020) investigated the effect of the COVID-19-pandemic on adolescents in stationary child and youth welfare in Switzerland, Luxembourg, Germany, and Austria. 238 participants aged 14-18 years ($M_{\text{age}} = 18$, 48.3% female) answered an online survey between the May 1st and June 8th, 2020. Adolescents in stationary care experienced an increase in isolation because of the restriction on visits of family and friends. As a positive change, they reported a reduction in domestic violence because of the visiting restrictions. The majority of adolescents would have rather been at home at the time of the survey. 58.3% saw their family less than usual, almost 30% didn't get any visits and 10% didn't have any contact (in person or via phone, etc.). Almost 40% of the adolescents in stationary child and youth welfare experienced a decrease in mental wellbeing. About 30% reported that they feel depressed since the start of the pandemic with just 16% indicating a positive change in their mental wellbeing. Especially kids who already experienced difficulties prior the pandemic suffered more. The same is true for physical wellbeing where 30% experienced a worsening.

Esposito et al. (2020) conducted a cross-sectional study in Italy analyzing the psychological impact and changes in lifestyle due to school closures during the COVID-19 lockdown. 2064 adolescent students aged 11–19 years (62.8% females; $M_{\text{age}} = 15.4$, $SD = 2.1$ years) completed an online survey between April 8th and April 21st, 2020. School closure was associated with the development of psychological problems and significant changes in lifestyle. The feeling of sadness was significantly more frequent in female than male participants (84% vs. 68.2%; $p < .001$) and in the older than the younger age group (79.2% vs. 70.2%; $p < .001$). The primary cause for sadness in all groups was loneliness. Another cause of sadness was missing the school community, which was significantly more common in female participants (26.5% vs. 16.8%; $p < .001$), in southern Italy (26.45% vs. 20.2%; $p = .01$) and in the age group of the 14–19-year-olds (24.2% vs. 14.7%; $p < .001$). Male gender was a protective factor against negative feelings ($p < .01$), whereas having a family member or an acquaintance with COVID-19 was a risk factor ($p < .05$). Regarding their relationship with their parents, 68.4% of the participants reported that their relationship remained the same while 24.5% of the females declared that their relationships with their parents had improved compared to 19% of the males ($p < .01$).

A qualitative study by Branquinho et. al. (2020) examined young people's experience of the COVID-19 pandemic in Portugal. 617 adolescents aged 16–24 years completed an online survey between 14th April and 18th May 2020. As positive result with respect to "social life and friendly relationships", the pandemic helped adolescents to understand the importance of relationships and to strengthen

and select friendly relationships. As negative effects, the pandemic led to a loss of contacts, making it impossible to socialize, and leading to a loss of important life moments among others. As neutral effects, adolescents mentioned technologies to keep in touch and remain relationships healthy. Regarding the domain “daily life and routines” positive effects were more time for pleasurable activities/thinking/setting goals, online lessons, start exercising and enjoying time with the parents. As negative effects, they outlined that days were monotonous/repetitive/boring, that missing routines make life disorganized/confusing as well as low productivity, procrastination, and interference with sports practice. As neutral effects adolescents mentioned normal life but at home, with time habituation. Regarding the domain of “health and well-being”, they highlighted the following positive effects: opportunities for personal growth, happier time with school closing, less tiredness and greater relaxation. Negative effects were: psychological symptoms, changes in sleep patterns, impossibility to play sports as before, greater use of technologies and substances, fights and constant discussions, economic impact on the household, school overload, missing sunbathing, increasing domestic violence and divorces. As neutral effect adolescents mentioned that health remained stable.

Sarkadi, Sahlin Torp, Pérez-Aronsson, Warner (2021) examined children’s expression of worry during COVID-19 in Sweden. They focused on the cognitive construct of worry for their qualitative analysis, which they coupled with quantitative analysis to compare participants’ responses. They developed an anonymous online survey with open-ended questions for their explorative, cross-sectional study. In total, 748 children (4–12 years) and 358 adolescents (13–18 years) participated. Parents assisted the completion of the survey for the younger group, whereas the adolescents have been asked to complete the survey on their own. The results show that worrisome thoughts were common for 77 % of the participants and that they were not significantly related to age ($p = .072$). There were neither relationships between housing type, taken as a proxy of socioeconomic status, and the presence of worry ($p = .120$) nor between worrisome thoughts and rural or urban living ($p = .142$). Furthermore, the results didn’t show a significant relationship between knowing someone with COVID-19 and the presence of worry ($p = .063$). The content analysis showed that the worry about disease or death was common in both age groups. Some of them were worried about getting sick or dying themselves, whereas some expressed being worried about others getting sick or dying. There were also concerns about others in the society like the risk group of elderly people. Existential worries were present in both age groups. But while the children were concerned about the long-term impact on day-to-day life, like “That we children are left alone when old people die.” (5 years old), adolescents made comments about economy aspects like “I worry my parents are going

to lose their jobs.” (14 years old). Further, the adolescents expressed worries about their own employment prospects like the difficulty to find a job in the future. Both age groups described to be worried of COVID-19 being unstoppable. A further category that was observed only for adolescents was the fear of missing out their youth due to COVID-19. Finally, there was a general worry for society, for instance the impact of COVID-19 on the healthcare system, which was exclusively seen in the adolescents group.

A cross-sectional study from Terzioğlu and Büber (2021) analyzed the traumatic effects of the COVID-19 in middle school students and caregivers. Parents/caregivers of 1059 students between 10 to 15 years completed the questionnaire (including IES-R, CRIES-13) between July 3rd and August 31st, 2020. While parents rated their own subjective anxiety and difficulty caused by traumatic events with the IES-R, answering the CRIES-13 gave information about the child. 20.9% of the children had CRIES-13 scores that indicated a risk for Post-Traumatic Stress Disorder. Children of divorced families ($p = .047$) and children of families with less than 2,500 Turkish Lira per month ($p = .028$) were more likely to have significantly higher CRIES-13 scores. Repeated experience ($r = .525$), avoidance ($r = .522$), and hyperstimulation ($r = .506$) subdimension scores of the IES-R were positively correlated with the CRIES-13 scores ($p = .0001$).

A German study by Rothe et al. (2021) aimed to investigate changes in emotions and worries during the lockdown period in 2020. The total sample of 284 participants included 111 children with a mental health condition and 173 without mental health condition. Parents compiled an online survey between April 4th and May 6th, 2020 for their children that were aged between 0 and 17 years. For children with mental health condition, the following emotions increased significantly ($p \leq .005$): feeling lonely, feeling fatigued or tired and enjoying activities. For children without a mental health condition, the following emotions increased significantly ($p \leq .005$): feeling worried, feeling lonely, feeling happy vs. sad, feeling fatigued or tired, and enjoying activities.

Davico et al. (2021) analyzed the psychological impact of COVID-19 on adults and their children in a cross-sectional study in Italy during the lockdown. A total of 786 children between 8 and 18 years ($M_{age} = 12.3$ years; $SD = 3.2$ years) compiled an anonymous online questionnaire between March 20th and 26th, 2020. The questionnaire comprised the CRIES-13 scale, which is commonly used to screen children at high risk for post-traumatic stress disorder. The total score median was (IQR 21.0 (11.0–32.0)), i.e., below the cut-off of 30 for being at risk for **PTSD**. However, for 30.9% of the children, the CRIES-13 score was 30 or greater, which indicates a high risk for post-traumatic

stress disturbances. There was no significant difference between children of health care worker parents [21.0 (9.0–31.7)] and those of non-health care workers [21.5 (12.0– 32.2)]. Children's and their parents' and their siblings' psychological impact were positively associated, suggesting a "family effect" for distress. Finally, there was a gender effects such that girls expressed higher distress levels than boys.

A qualitative study from Scotland (McCluskey et al., 2021) that is part of a large-scale national study 'In isolation instead of in school' (INISS) aimed to analyze the impact of COVID-19, and specifically school closure, on young people's mental health. The authors conducted four focus group with a total of 45 young people between 14 and 18 years, in August and September 2020. All semi-structured interviews were executed online and between 60 and 90 minutes long. Regarding to the 'impact of isolation, home learning and exam cancellation on mental health' participants reported an (a) initial positive impact of lockdown on young people's mental health. (b) Home learning was experienced differently. For some of the students, it was stressful and difficult to maintain motivation for learning. For others, the greater opportunities for self-directed learning were enjoyable. (c) For most of the students, the exam cancellations have been appreciated but also caused anxiety and uncertainty. Regarding the 'impact on the mental health of groups of young people typically identified as vulnerable', participants mentioned the following groups: "young people with pre-existing mental health conditions; young people who receive additional support with learning; those living in households where there is violence and abuse; young carers; those living in a family where someone had developed long COVID, and members of some minority groups, such as LGBT+". The experiences of 'returning to school', was rated in positively as well as negatively. Regarding the question what had helped and what could help mental health and wellbeing, participants indicated that they would have liked more mental health support in schools.

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 that 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 8th and 24th, 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 because 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, 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.

A cross-sectional study from Austria (Schabus & Eigl, 2021) examined **stress** and **psychosocial consequences** of the COVID-19 pandemic between February 21st and April 19th, 2021. A total of 5'008 children between 6 and 18 years participated, within three age groups: 6 to 10 years ($n = 949$), 11 to 14 years ($n = 1'930$) and 15 to 18 years ($n = 2'129$). The results show that especially the youngest age group have the greatest fears about Corona and the current situation. The types of fears are, "That it will be a long time before life will be the same as before" (54.5%), "That life will not be the same at all" (50.1%), "That loved ones might die" (48.1%) and "Not being able to have

the same future opportunities as before Corona" (36.8%). Adolescents said they were afraid of no longer having the same future opportunities (47.8%). The younger children get their information about Corona mainly from their parents and family (67.3%). The adolescents get their information mainly from social media and the internet (46.9%). 71.8% of children and adolescents reported feeling "much" (25%) or "a little" (46.8%) worse than before Corona. 75.6% expect a return to normality in 2022 at the earliest. Since Corona, 58.2% of the children and adolescents feel "more often angry and annoyed", 46% "more often lonely and alone" and 42.7% "more often sad". 15.6% feel "good despite Corona" or even "better" (13.6%). What children and adolescents miss the most is "being able to meet friends without restrictions" (71.4%), "not having to wear a mask and seeing people's faces" (58.7%) and "being able to do sports". The second most frequent answer given by young people was that they miss "going out" (58.7%). The youngest age group suffers the most when it comes to changes in the school day (72.2%). 42.1% miss the daily routine a lot and 30.1% quite a bit. Children and adolescents overestimate their risk of becoming hospitalized because of a SARS-CoV-2 infection with 1 to 3 in 100 (i.e., 1.2 to 3.3 %) although the actual risk in this young age group is less than 1 in 10'000 (i.e., 0.01 %) in children and adolescents with risk factors and 1 in 40'000 (i.e., 0.003 %) in children and adolescents without risk factors. Children who stated that their parents consider Corona "dangerous" or "very dangerous" stated that they "almost never saw their loved ones" (44.6% vs. 33.6% for non-anxious parents). The same children are also slightly more afraid of the virus (47.1% vs. 40.1%) and rate Corona itself as "dangerous" or "very dangerous" (84%). The primary fear among children with anxious parents is that "relatives will die" (61%) or "get sick" (42.6%). Among children with less anxious parents, the primary fear is that "life will never be the same" (61.6%) and "not having the same opportunities in the future" (44.8%). The same group also reported feeling "angry and annoyed" more often (63.5% vs. 52.6%).

Psychological distress and loneliness

On behalf of the COVID-19 Taskforce of the Swiss Federal Office of Public Health (SFOPH), Bosshard et al. (2021) from the Sotomo Research Institute conducted a special analysis of their data, which they collected as part of the SRG Corona Monitor during eight survey waves between March 2020 and July 2021 and in which between 30'000 and 50'000 people aged 15 and older participated. The results show that the crisis situation had a greater impact on the emotional state of the younger generation (especially the 20–25-year-olds) than on the older generations. The younger generation also coped worse with the pandemic than the older generation. The age group between 20 and 25 rated their own situation the worst (in March 2021, 11% of the 20-25-years olds reported that they were coping very poorly and 26% poorly with the current situation.) The results also show

that the pandemic has changed the financial situation of the younger generation more compared to the total population, but in both directions. 40% of the participants aged 20-25 and 37% 15-19-years-olds reported having more savings than before the pandemic. 50% of the adolescents aged 15-19 and 37% of the 20–25-year-olds reported that the savings remained unchanged. At the same time, savings decreased for a quarter (24%) of those aged 20-25-years-olds and 13% of those aged 15-19 years. Furthermore, young adults feared increased social isolation, restricted freedoms, and private conflicts as a result of the pandemic.

The “Beratung 147.ch” helpline that is offered by Pro Juventute in Switzerland reported that consultations on the topic of “loneliness” increased by 37% in 2020 compared to 2019, and consultations regarding “losing friends” increased by 93%. With the start of the second wave from October to December 2020, the number of consultations regarding “mental disorders” increased by 40%. Furthermore, the number of consultations by adolescents who were seeking help in an acute crisis increased by 29% in 2020 compared to 2019. In general, young people sought more advice about family conflicts and domestic violence throughout the year. During the first lockdown, inquiries about “conflicts with parents” increased by 60%, “conflicts with siblings” by 100%, and “domestic violence” by 70% (Meier, 2021).

Also in Switzerland, okay zurich asked their youth workers about their opinion on how the children and adolescents are doing. Particularly in January and February 2021, young people were increasingly frustrated and anxious as evidenced by their destructive behaviour. For adolescents aged 16 and older, the constraints of the pandemic were and continued to be drastic and persistent. 69% of the youth workers reported that children and adolescents have adapted to the situation of the lockdown. 55% stated that young people suffered rather much and 24% indicated that they suffer very much from stress and were increasingly worried about the future (e.g., negative thoughts, fears about school, apprenticeship). Suicide was raised as a topic among young people more often than before the COVID-19 pandemic. The uncertainty of how long the pandemic and the measures would last had caused frustration, but also a great impatience, among some young people (Levy & Petrušić, 2020).

In an exploratory study, Crescentini et al. (2020) examined the impact of the COVID-19 pandemic on Italian parents’ and children’s internalizing symptoms. An online questionnaire was filled out twice by 721 parents of at least one child aged between 6 and 18 years ($M_{age} = 10.08$, $SD = 2.52$ years): once they were asked to refer to the current emergency condition and once to recall how

their child felt a few months before the COVID-19 outbreak. Internalizing symptoms of children were significantly higher during the COVID-19 pandemic than in the last months of 2019 with respect to for Child Behavior Checklist Withdrawn/Depressed ($p < .01$), Anxiety, and Somatic Complaints (p 's $< .05$). Multiple regression analyses showed that specific demographic characteristics (i.e., sex and age) and psychological factors of children and parents, such as fear of contagion and the opportunity to think about possible secondary positive effects of the pandemic, had a predictive value on the presence of internalizing symptoms of both parents and children.

An Italian study from Pasca et. al. (2021) evaluated the impact of the COVID-19 pandemic in 23 pediatric patients with epilepsy. The patients were questioned between April and May 2020 with questionnaires and phone calls. They were divided into two groups: patients with neurocognitive comorbidities and patients with internalizing problems. Concerns for therapy monitoring at the time of lockdown emerged in 43% of families, and 30% of patients showed worries for an altered contact with the referring medical team. Also, out of the four patients which were undergoing rehabilitation at t0, none was able to continue that therapy at t1. Of the 7 patients undergoing psychotherapy at t0, only three were able to keep on with the treatment at t1. The Child Behavior Checklist (CBCL) showed that the profile of patients with neurocognitive comorbidities diverges from the one of patients internalizing problems. Whereas patients with neurocognitive comorbidities had increased scores in 'total external', 'attention problems', 'aggressive behavior', 'anxious-depressed', for patients with internalizing problems, a decrease of 'aggressive behavior', 'rule-breaking behavior', 'withdrawal', 'attention', 'total external', and 'social problems' has emerged. Total external problems generally increased at t1 in patients with neurocognitive comorbidities compared to patients with internalizing problems ($p = .085$), and aggressive behavior worsened in patients with neurocognitive comorbidities compared to patients with internalizing problems at t1 ($p = .002$).

A Spanish study by Romero et al. (2020) investigated the stay-at-home effect on 3-12 year-old children. Although the majority of children (i.e., more than 55%), according to parents' information, showed no change in their behaviors, some patterns of change were observed. Thereby, a higher proportion of children (i.e., 30–40%) showed increases in negative outcomes such as conduct problems (29.4%), emotional problems (27.4%), and hyperactive behavior (39.5%) as compared to the pre-confinement situation than decreases in negative outcomes. Regarding child positive outcomes, little changes or differences were observed for routine maintenance, prosocial involvement and social bonding, while social reflection yielded a marked increase (61.1%). There were significant differences ($p < .01$) across age groups in conduct problems, hyperactivity, social-

oriented reflections and social bonding: preschool children (3 to 6 years) showed a higher increase in conduct problems and hyperactivity as compared to their school-aged children; school children showed a higher increase in social-oriented reflections and social bonding with their relatives and peers as compared to preschool children.

A longitudinal UK study in school children analyzed proxy and child-reported data from before and during the lockdown. A significant increase in depression symptoms during the UK lockdown was observed, as measured by the Revised Child Anxiety and Depression Scale (RCADS) short form. CIs suggest a medium-to-large effect size (CI [(95% CI 0.46, 1.01)]. In addition, regression models yielded non-significant changes in the Strength and Difficulties Questionnaire (SDQ) with respect to emotional problems ($B = -0.25$, 95% CI [-0.54, 0.05]) and the anxiety scores in the Revised Children's Anxiety and Depression Scale (RCADS) ($B = -0.06$, 95% CI [-0.34, 0.23]) during lockdown compared with before. In contrast, standardized RCADS depression scores were on average 0.74 (95% CI [0.46, 1.01]) higher during lockdown than before. Controlling for demographic factors separately (age, gender and SES) did not strongly alter the effect estimates (Bignardi et al., 2021).

A longitudinal study from the Netherlands (Achterberg et al., 2021) examined whether perceived stress mediated the lockdown effects on children. A total of 106 parents and 151 children (aged 10-13 years) filled in questionnaires during lockdown and data were combined with data of previous years. Children's externalizing behavior (measured by the Strength and Difficulties Questionnaires (SDQ)) during the lockdown was significantly predicted by prior externalizing behavior ($p < .001$). However, longitudinal child measures showed a gradual decrease in internalizing and externalizing behavior, which seemed decelerated by the COVID-19 lockdown. Overall, relatively few parents (19%) and children (21%) reported stress in the last two weeks of lockdown. Stress measured with the Perceived Stress Scale (measured on a 0–4 scale) ranged between 0 and 2.4 in parents and between 0 and 2.8 in children. Perceived stress of children and parents were not significantly correlated ($p = .209$). However, changes in parental negative feelings and children's externalizing behavior were mediated by perceived stress: higher scores prior to the lockdown were related to more stress during the lockdown, which in turn was associated with an increase in parental negative feelings and children's externalizing behavior. Perceived stress in parents and children was associated with negative coping strategies. Additionally, children's stress levels were influenced by prior and current parental overreactivity.

Giannopoulou et al. (2020) examined the impact of the lockdown on anxiety and depression among 459 senior high school students in Greece. The proportion of all respondents who screened positive for anxiety ($GAD-7 \geq 11$) increased from 28.3% before the pandemic to 49.5% for the time of home confinement ($p < .0001$). The proportion of all respondents who scored above the Patient Health Questionnaire-9 (PHQ-9) cut off 11 or greater indicating positive screen for depression increased from 48.5% before the pandemic to 63.8% for the time of home confinement ($p < .001$). The proportion of respondents who reported having thoughts that they would be better off dead, or of hurting themselves in some way increased from 25.9% before the pandemic to 29.7% during the lockdown period ($p < .05$). More specifically, the proportion of those who reported having these thoughts nearly every day increased from 6% before the pandemic to 11.1% during the lockdown. The comorbidity, defined as positive screen for depression and anxiety, increased from 24% to 45% ($p < .0001$) and for males from 14.8% to 37.8% ($p < .00001$). After taking sex and baseline levels of depression and anxiety one month prior to the lockdown into account, the level of lockdown experienced distress was predictive of depression and anxiety levels in time of home confinement, accounting for about 30% of variance in symptoms severity scores.

A Spanish study by Ezpeleta et al. (2020) investigates the life conditions of adolescents during lockdown and the association with psychological problems. 226 parents (117 girls/109 boys, $M_{age} = 13.9$, $SD = 0.28$) answered an online survey about their children. After the lockdown, the following problems increased significantly: conduct problems ($p = .006$, small effect size), peer problems ($p < .001$, moderate effect size), prosocial behavior problems ($p < .001$, large effect size) and total difficulties ($p = .005$, small effect size). There was no significant change in hyperactivity-inattention problems after the lockdown. Higher emotional problems were associated with sleep problems, feelings of frustration, a low quality of the adolescent's relationships (lack of online communication with friends, worsened family relationships), adolescents' activities (not keeping up daily routines, (parents overburdened with helping with homework, not doing joint activities with the family, boredom, excessive screen time), and with behaviors of the adults (parents giving up enforcing the rules and more discussions/stress than usual in the family at home) as well as their own concern about contagion. Higher conduct problems scores were mainly associated with adolescents' relationships, how the adults in the household behaved, and the adolescents' activities. Higher hyperactivity-inattention problems scores were mostly associated with the adolescents' activities. Higher peer problems scores were associated with the adolescents' activities. Higher prosocial problems scores were mostly associated with the behavior of the adults. Higher total problems scores were associated with the adolescents' activities, followed by the adolescents' relationships,

the adults' behavior, and last changes in weight (4.3%). Effect sizes ranged from small (0.04) to large (0.36).

A cross-sectional Italian study by Smirni et al. (2020) investigated anxiety levels in older adolescents due to the pandemic of COVID-19. 148 adolescents aged 17-19 years completed online two questionnaires between April 15th and May 15th, 2020: one was the Self-Rating Anxiety Scale (SAS), a scale from 1-4 with 4 defining "most or all of the time" and a SAS index of 80 equaling severe anxiety, and the other was the Italian Emotion Awareness Questionnaire (EAQ), a scale from 1–3 with 3 defining "Often true". The results from the SAS show that the item with recording the highest scores was "I can breathe in and out easily" with a mean of 3.4±0.81 and SAS index of 85. As an explanation, the authors suggest that breath is perceived as a very easy vehicle for virus transmission, and that the coronavirus mainly affects respiratory functions, while breathing difficulties are among the first manifestations of viral activity in the human body. The second highest score was "I fall asleep easily and get a good night's rest", mean 2.6±0.10 and SAS index 65. Regarding the EAQ "Attending to others' emotions", "analyses of own emotions", and "differentiating emotions" were the subscales with the highest scores, indicating high specific emotional abilities. The score was between two and three for these items. Overall, over half of the SAS items indicated a high anxiety score in the adolescent sample and also in the EAQ, the scores reached high levels indicating that the adolescents have valid emotional abilities.

Ravens-Sieberer et al. (2020) investigated the impact of the COVID-19 on health-related quality of life (HRQoL) and mental health of children and adolescents in Germany. A representative online survey was conducted among 1586 families with 7- to 17-year-old children and adolescents between May 26th and June 10th, 2020. Results show that before the pandemic, 15.3% ($n = 146$; based on weighted data of the BELLA study) of children and adolescents reported low HRQoL; during the pandemic, 40.2%. An analysis stratified by gender revealed that a higher proportion of girls reported low HRQoL than their male peers both before and during the pandemic. Younger children were affected significantly more than older ones; the percentage of children reporting low HRQoL rose from 7.7% to 41.3% in 11- to 13-year-old children and from 17.1% to 39.3% in 14- to 17-year-olds ($p < .001$). Children from families with (1) low education levels, or (2) less than 20 square meters of living space per person, or (3) a migration background were considered to be at a high risk of suffering a sizable impact.

A Spanish cross-sectional study from Pons et. al. (2020) collected data of different 833 young high-level athletes regarding the impact of COVID-19 pandemic on their mental health and life-spheres. The athletes were from 26 different sports clubs and sports institutions. A Spanish version of the General Health Questionnaire-12 (GHQ-12) was given to the athletes which lead to following results. Regarding the different life-spheres, the impact seems to be more negative on dual career ($M = 3.6$; $SD = 0.7$; Rank = 1–5) and health domains ($M = 3.3$; $SD = 0.7$; Rank = 1–5) than on the rest and recovery domain ($M = 2.9$; $SD = 1.0$; Rank = 1–5). For mental health issues, young athletes reported, on average, higher anxious/depressive ($M = 3.5$; $SD = 1.0$; Rank = 1–7) and social dysfunction ($M = 3.5$; $SD = 1.5$; Rank = 1–7) symptoms in comparison with loss of confidence ($M = 2.6$; $SD = 1.7$; Rank = 1–7). Descriptive results also indicate positive correlations between life-spheres and mental health, with ranging magnitudes from 0.13 to 0.59 among them. Notably, social dysfunction showed to be the most correlated factor with the negative impact on life-spheres subscales (dual career: $r = .43$, health: $r = .58$, rest and recovery: $r = .26$). The results also show that the impact of the lockdown on the athletes' life spheres and mental health was low in 54.78%, moderate in 29.96%, and high in 15.26% of the athletes. Participants in the high impact cluster were pursuing higher academic courses than those in the low impact cluster and the high impact cluster had a worse socioeconomic level than medium and low impact ones. The high impact cluster was composed mostly of female athletes with lower socioeconomic level, pursuing a more demanding academic course and reporting worse training conditions than their counterparts.

Symptoms of depression, anxiety and stress, and the psychological impact of the lockdown situation in Spanish population were longitudinally analyzed using the Depression Anxiety and Stress Scale (DASS-21) and the Impact of Event Scale (IES) by Planchuelo-Gómez et al. (2020). 4724 participants filled in two surveys between March 28th and April 5th, 2020 (t_1) and April 28th, 2020, and May 15th, 2020 (t_2). Symptomatic scores of anxiety, depression and stress were exhibited by 37.22%, 46.42% and 49.66% of the second survey respondents, showing a significant increase compared to the first survey (32.45%, 44.11% and 37.01%, respectively). Regarding the intrusion and avoidance scores remained on a high level during both timepoints. Authors discussed that consumption of information about COVID-19 and physical activity seemed to have an important role in the evolution of psychological symptoms.

Pigaiani et al. (2020) investigated lifestyle behaviors and coping strategies among Italian adolescent aged 15-21 years and whether they would predict a change in subjective wellbeing between April 1st and April 10th, 2020. 306 surveys were returned. Most adolescents planned their daily routine

(57.8%), engaged in structured activities (17.6–67.3%) developed new interests (54.6%), and gave a positive reading of the ongoing period (57.8%), thus revealing adaptive coping strategies. However, a change in subjective wellbeing (49.3%) and symptoms of anxiety (39.9%) were frequently reported. A number of factors predicted such changes in subjective wellbeing: physical activity, $OR = 2.609$, 95% CI [1.297,5.247]; engaging in different activities than before, $OR = 2.212$, 95% CI [1.157,4.230], family issues (finding it hard to stay at home, $OR = 3.852$, 95% CI [1.953, .599]; having quarrels, $OR = 2.158$, 95% CI [1.122, 4.150]), and school-related behaviors (fearing a negative educational outcome, $OR = 1.971$, 95% CI [1.063, 3.655]). These factors included adaptive coping strategies such as physical activity and engaging in different activities than before. Other than that, a relevant proportion of adolescents shared their feelings (40.5%) and reevaluated their family relationships (29.4–39.7%) even though it was hard to stay at home (66%) and master the difficulties that emerged, including self-isolation (50.7%) and quarrels (31.7%). In terms of social and school engagement, almost all adolescents kept contacts with their partner, friends, and teachers (90.2–93.5%). School commitments at home were sufficiently preserved (63.1%), however adolescents expressed preoccupations about their educational path (56.2%).

Orgilés et al. (2020) investigated the emotional impact of the quarantine on children and adolescents from Italy and Spain. Participants were 1'143 parents of Italian and Spanish children aged 3 to 18 years who completed a survey providing information about how the quarantine affected their children, and themselves. Children presented the following symptoms of emotional changes: difficulty concentrating (76.6%), boredom (52%), irritability (39%), restlessness (38.8%), nervousness (38%), feelings of loneliness (31.3%), uneasiness (30.4%), and worries (30.1%). Spanish children were significantly more psychologically affected than Italian children (88.9 vs. 83.8%; 95% CI [0, 0.77], $p = .05$). Furthermore, during the quarantine, children spent more time using screens such as iPads, TVs, mobiles, or computers (95% CI [55.38, 76.25], $p < .001$); spent less time doing physical activity (95% CI [0.03, 0.04], $p < .001$); and tended to sleep more (95% CI [1.07, 1.42], $p < .01$). When family coexistence during the quarantine was rated as more difficult, the parents tended to rate their children as more restless, more anxious and having more difficulty concentrating.

The objective of the Spanish study by Giménez-Dasí et al. (2020) was to investigate the psychological effects that the confinement measures have had on the psychological well-being of a sample of children aged 3–11 years from Madrid. A total of 167 families with children participated. The parents evaluated the children through the System of Evaluation of Children and Adolescents

(SENA) scale in the months of February and April. The results show significant changes in most of the indicators evaluated in the older children of the sample (6–11 year-old). They showed increased attention ($p = .02$) and emotional regulation problems ($p = .01$), and hyperactivity and impulsivity ($p < .001$). Moreover, their willingness to study decreased ($p < .001$). These changes, however, were not observed in the younger children of the sample (3-6-year-olds; $p = .19$). Despite the fact that Early Childhood children did not show a significant worsening, when the families described the observed changes, they mentioned similar symptomatology to that manifested by Primary Education children. These changes have to do mainly with regulatory skills and are manifested in behaviors related to executive functions (emotional regulation, attentional control, hyperactivity, and impulsivity).

A cross-sectional study from Di Giorgio et al. (2021) investigated how the restrictive measures impacted mothers and their pre-school children's behavioral habits (sleep quality and subjective time experience) and psychological well-being (emotion regulation and self-regulation capacity). 245 mothers with children between 2 and 5 years were recruited via online ads and social media. All outcomes were collected during the period April 1st to 9th, 2020, during quarantine, and retrospectively for before the national lockdown. Mothers reported an increased sense of boredom during the lockdown in their children ($p < .0001$), mothers who kept working in smart modality. Children also showed increased difficulties to follow daily routines ($p < .0001$), although their ability to keep track of the passage of time did not change during the lockdown ($p = .938$). Focusing on the executive functions as measured by the Behavior Rating Inventory of Executive Functions (BRIEF-P), children showed an increased score in the Inhibitory Self-Control Index (ISCI) ($p = .007$), with the proportion of children with self-control difficulties (i.e., ISCI > 65) increased from 14.29% before the lockdown to 21.23% during the lockdown ($p < .001$; $OR = 6.67$). Looking at the subscales of the Strength and Difficulties Questionnaire (SDQ), we observed an increase in emotion symptoms (EMO) ($p = .011$), conduct problems (COND) ($p = .003$), and hyperactivity/inattention (HYPER) issues ($p < .0001$) during the lockdown, regardless of the mothers' working situation.

A cross-sectional study from Cusinato et al. (2020) involved 463 Italian parents of children aged 5-17. All participants completed an online survey consisting of the Psychological General Well Being Index (PGWB) to assess parental well-being, the Strengths and Difficulties Questionnaire (SDQ) to measure children's well-being, the Parent Stress Scale (PSS) to investigate parental stress, and the Child and Youth Resilience Measure (CYRM-R) to measure children's resilience.

Confinement measures and changes in daily routine negatively affected parents' psychological dimensions, thus exposing children to a significant risk for their well-being. As risk factors for psychological maladjustments, the study identified parental stress, lower levels of resilience in children, changes in working conditions, and parental psychological, physical, or genetic problems. Complementary, higher levels of children's resilience were a protective factor for their well-being as documented in the correlation between the CYRM-R total scores (where higher scores equal more resilience) and the SDQ scores, (where lower scores equal less problems) with values ranging from $r = -0.40$ to $r = -0.63$.

Domínguez-Álvarez et al. (2020) examined the effects of child coping and its interactions with contextual stressors (pandemic and family related) on child adjustment. Data was collected of 1'123 Spanish children aged 3 to 12 years in April 2020, through parent-reports. The use of specific coping strategies by children differed between different age groups (i.e., 3–6, 7–9, and 10–12-year-olds); preschoolers tended to use more predominantly strategies such as "yelling or getting angry" ("yelling" $M = 1.18$, $SD = 0.73$), whereas early adolescents' repertoire of behavioral and cognitive coping skills becomes more diverse. Regarding the coping, child disengagement coping was distinctively associated to negative outcomes (i.e., higher levels of behavioral and emotional difficulties), whereas engagement coping predicted psychosocial adjustment across all age groups. Moreover, interactively with child coping, parent fear of the future and parent dispositional resilience appear as relevant contextual factors to predict both negative and positive outcomes, but their effects seem to be age dependent, suggesting a higher contextual vulnerability for younger children such that lower levels of parent resilience interacted with high levels of child disengagement coping to produce higher levels of emotional problems ($\beta = -0.07$, $p < .02$).

A cross-sectional study by Akkaya-Kalayci et al. (2020) compared mental health of Turkish natives, Austrian natives and Turkish migrants living in Austria ($N = 1240$, age range 15–25 years). Data was collected between May 22nd and June 19th, 2020. The study took into consideration that some of the participants were already in mental treatment. Native Turkish, native Austrian and Austrian migrants differ in their mental health as well as in adversity (e.g., financial problems; both p 's $< .001$). Native Austrians had less fear of being infected or that a family member is being infected than migrants ($p = .022$). They also had less fear than native Turks living in Turkey ($p < .001$). Moreover, native Turks think a lot more of COVID-19 than native Austrians and migrants in Austria ($p < .001$). Native Turks reported more decreases in their mental health than both other groups. Generally, in all three groups, participants who already had financial problems and those who were already in

mental treatment had a higher probability of reporting a decrease in their mental health condition. In addition, in all three groups, female participants and young participants reported higher fears, depression, and worse self-control as well as worse general health.

In a cross-sectional study, Montserrat et al. (2021) investigated the well-being and satisfaction of children in residential care during lockdown. The aim of the study was to analyze the perception of the lockdown and mobility restrictions of these children and to evaluate their subjective wellbeing (SWB) and satisfaction during lockdown. The authors developed a questionnaire which has been answered by 846 children between 10–17 years in Spain (specifically Catalonia) between June and July, 2020. 71.2% of the respondents were boys and 28.8% girls. The majority was in the 14–17 years age group (82.7%). The perception of the different aspects of lockdown have been grouped in the following seven thematic blocks: “information received; habits; personal space; interpersonal relationships inside and outside the children's home; school; use of time and use of new technologies”. Girls had a lower SWB score (four points lower) than boys of the same age ($p < .01$). Children who had not been given the information by their caregivers scored on average six points lower in SWB ($p < .01$). The SWB of children who felt that the relationship with their caregivers remained the same or improved during lockdown was higher compared to those children who thought the relationship had worsened ($p < .01$). The same effect was obtained for children who claimed that the relationships with their classmates have improved, they scored in average 7 points higher on the SWB scale ($p < .01$). Similarly, better grades were also associate with higher SWB scores and children who claimed to have felt more alone during lockdown had lower levels on SWB compared to others ($p < .01$). In general, boys and girls both had higher SWB scores if they perceived to have more time to relax, talk, play or use social media rather but not if they felt that they have less time for these activities ($p < .05$ and $p < .01$, respectively). Whereas being able to share their concerns with others had a positive effect, being bullied during the lockdown had a negative impact on children’s well-being. For boys, positive SWB was related to a good relationship with their caregivers ($p < .01$), not feeling alone during lockdown ($p < .01$), having had the same or more time to relax, talk or play ($p < .01$), having used social networks more ($p < .01$), and having played video games for the same amount of time ($p < .01$). For girls, positive SWB was related to a good relationship with caregivers. The SWB score was much lower (12.8 points) when the perceived relationship during lockdown was worse. Moreover, being able to explain problems to others was related to higher SWB scores ($p < .01$) as was being younger (older girls’ score was 5.8 points lower). Only for girls, an improvement of the relationship with classmates ($p < .01$) as well as better grades ($p < .01$) were associated with better SWB scores. Having worse grades as well as

having been bullied during lockdown had a detrimental effect on SWB (on average, about 15-point decreases; $p < .01$).

Regarding the organizational changes due to home office and school closures for Italian families, Mangiavacchi et al. (2021) examined how the lockdown affected children's use of time, their emotional status and their home learning, and whether the reallocation of intrahousehold responsibilities during the lockdown played a role in this process. They developed a web survey and collected data of 3'352 Italian families with children under 16 years during April 7th and May 3rd, 2020. The results show that there has been a significant change in the division of household tasks during lockdown and as a consequence an increase in the time available for housework and childcare. Regarding the daily activities of the children, the collected data shows how much the typical day of children has changed during lockdown. There was a decrease in "productive" activities such as school, homework and extracurricular activities and an increase of "non-productive" time, including TV, passive screen time, social networks, and others. Kids between 3-10 years already spent 1.5 hours per day watching TV and this increased up to 2 hours for older kids. During lockdown, the children watched approximately twice as much as before lockdown. The average of the educational progress rated by the parents of children was approximately 4.8 on a scale from 0 to 10. It's notable that there was a substantial heterogeneity by school level and by whether the school implemented live online classes. Furthermore, children's emotional wellbeing during the lockdown decreased, while their personal relationship with their parents slightly improved. The negative effect on children's wellbeing was significantly smaller when the father was the main caregiver.

A longitudinal study by Liang et al. (2021) investigated the changes in adolescents internalizing symptoms (anxiety and depression) during the pandemic by administering online surveys at three time points (*T1* two weeks after home confinement in March 2020; *T2* five weeks after home confinement; *T3* at the end of home confinement in May 2020). A total of 1'053 Italian parents participated on behalf of their children aged 11-18 years ($M = 14.13$, $SD = 2.25$, 49.1% girls) in at least one of the surveys. Results show that adolescents' anxiety symptoms different between the three time points, with small effect sizes ($p = .008$, $\eta_p^2 = .017$). Anxiety symptoms increased from *T1* to *T2* ($p = .016$) and decreased from *T2* to *T3* ($p = .017$). Depression symptoms also differed between time points ($p = .002$, $\eta_p^2 = .021$) and increased from *T1* to *T2* ($p = .002$), but not to *T3*. 31.9% of adolescents scored above the cut-off point for anxiety and 17.7% scored high for depression. After controlling for sociodemographic variables, parental stress was positively

associated with anxiety symptoms ($p = .000$) and depression symptoms ($p = .000$) of adolescents at T3. Together, long-term home confinement increased adolescents' internalizing symptoms, which are further increased by high levels of parental stress.

A study from Spain (Giner-Murillo et al., 2021) evaluated lifestyle behaviors and mental health of undergraduate students several months after the lockdown and compared them with an age and sex-matched control group who reported not studying. A sample of 442 matched participants (73.3% female, mean age 21.86 ± 2.12 years for students and 22.86 ± 2.48 years for controls) who had answered the cross-sectional web-survey between November 16th and December 16th, 2020 were analyzed. Undergraduate students presented a higher mean on the SMILE-C global lifestyle questionnaire than controls ($p < .001$). However, differences disappeared after controlling for the effect of several covariates on the SMILE-C score ($p = .162$). Thereby, SMILE-C scores were associated with the number of cohabitants, self-rated health, screening for anxiety, having experienced financial difficulties during the pandemic, and changes in stress management and in restorative sleep. Whereas screenings of depression and alcohol abuse did not differ between students and controls, students reported lower rates of anxiety (28.5% vs. 37.1%; $p = .042$). In both of the groups associations with unhealthier lifestyles were found for a lower number of cohabitants, poorer self-perceived health and positive screening for depression and anxiety, or for depression only ($p < .05$). A history of mental illness and financial difficulties were predictors of unhealthier lifestyles for students, whereas total/moderate changes in substance abuse and stress management ($p < .05$) were predictors for the control group. The authors recommend that more attention should be paid to changes in lifestyle behaviors of the young adult population during health crises, such as the current pandemic, to identify risk and protective factors as well as markers of resilience.

A Spanish cross-sectional study (Forner-Puntonet et al., 2021) conducted in August 2020 at the start of the second COVID-19 wave evaluated and compared the exposure, impact, and experience of the pandemic on families of solid organ transplant (SOT) recipients and healthy controls. Parents of 48 SOT children and parents of 48 age and sex matched controls (children sample 52.1% boys; 8.6 ± 4 years) answered an online questionnaire based on demographic characteristics and the COVID-19 Exposure and Family Impact Survey (CEFIS). Regarding the impact experienced by families, caregivers reported on their own distress and that of their children. 59.4% of the respondents reported an improvement in the relationships among family members. Analysis of open-ended questions showed that parents perceived an increase in anxiety symptoms in their

children and an increase in the amount of time spent using technical devices. Parents were concerned by their children's loss of social relationships and physical exercise habits.

A qualitative study of Huscsava et al. (2021) investigated the switch from face-to-face to teletherapy on young patients with a psychological disorder in Austria. The participants ($N = 30$) were on average 16.21 years old ($SD = 1.57$ years; Range from 12 to 18 years), mainly female (87%), and almost all lived at home (90%). The data was collected at some point in the lockdown (the exact dates are unclear). Interviews were conducted for this purpose. The following data was collected in the semi-structured interviews: symptoms, substance use, social context and perception of COVID-19-associated measures. The main results were the following: 20% of the adolescents reported childhood adversities. Some patients reported an increase (3%) and others a decrease (10%) in physical violence in the household within the first two months of lockdown. Most patients who had experience with sexual violence reported a decrease (80%) during the crisis, while 20% mentioned no change in this time. 50% of the participants who had been victims of neglect in the past reported an increase in neglect during the lockdown, while 40% reported a decrease of neglect during that time. Anxiety symptoms became worse for 43% of the patients, while 10% noted an improvement. A decrease of mood was reported for 73% of the patients, while 17% perceived an improvement. Patients reported an increase in tense (40%), non-suicidal self-injury (45%) and obsessive-compulsive disorder (OCB; 80%), alcohol (7%) and tobacco (17%) consumption. Three themes were found in the qualitative analyses: changes in the structure of thoughts, feelings of isolation and a reduction in school-associated stress. Rumination seems to be a factor that contributes to the deterioration of the psychosocial functioning level.

In a mixed-method study, Postigo-Zegarra et al. (2021) investigated the psychological impact of COVID-19, especially the relationship between family conflicts and psychological distress among parents and their children during the domestic lockdown and social isolation. A total of 142 participants participated in the study out of which 61 were adolescents and 81 were parents. Three different types of adaptation to lockdown and social isolation were observed in both adolescents and their parents: 1) positive adjustment, 2) moderate adjustment, and 3) maladjustment. Most participants reported a good adjustment and only a 20% of parents and a 16% of adolescents stated that they had not been able to achieve a positive psychological adjustment. The qualitative analysis of data showed that adolescents reported less psychological distress than their parents. The two most important protective factors were social support and keeping busy during lockdown. The most significant risk factors were loss of mobility and social isolation.

A service evaluation from Staite et al. (2021) compared the data before and after treatment from the Child and Adolescent Mental Health Service (CAMHS) crisis team in the UK during the COVID-19 pandemic. The CAMHS Crisis Team is for young people between 7 and 18 and offers a 24-hour service on 365 days for mental health crisis. They compared the data of 366 patients on their functioning as measured by the Outcome Rating Scale (ORS) between December 2019 and December 2020. After the intervention, the mean ORS increased by 79.19% (pre-treatment $M = 18.16$; post-treatment $M = 32.54$) and ORS scores were higher at the end of the treatment ($p < .001$) with a large effect size ($d = -1.56$). 58% of patients exhibited significant and reliable change. No patients significantly deteriorated in functioning after the crisis service. These findings highlight the effectiveness of the work of the CAMHS crisis team in improving the function of young people who experience a mental health crisis.

A cross-sectional study from Italy (Cattelino et al., 2021) analyzed the relationship between emotional and self-regulated learning self-efficacy, subjective well-being (SWB) and positive coping among 485 Italian students (74% girls; $M_{age} = 19.3$; range 14-24 years; $SD = 2.4$) in an online survey during the COVID-19 pandemic lockdown (May 13th to June 2nd, 2020). Compared to girls, boys reported greater confidence in their ability to manage negative emotions, greater positive coping, and greater well-being (all p 's = .001). Self-regulated learning self-efficacy was positively related to both of the well-being latent variables (.19 for positivity and .31 for hedonic balance). Self-efficacy in regulating positive emotion was positively related to positivity (.43) and hedonic balance (.28). Significant positive relations were found between Self-efficacy in regulating negative emotion with positivity (.27), hedonic balance (.43) and positive coping (.36). Hedonic Balance was positively related to positive coping (.28). Positivity and self-regulated learning self-efficacy and self-efficacy in regulating positive emotions were not related to positive coping. In conclusion, self-efficacy was strongly related to regulating positive emotions and positivity, as well as negative emotions and hedonic balance, highlighting its' importance as a protective factor.

Pierce et al. (2021) investigated the trajectory of mental health and well-being between April and October 2020 relative to pre-pandemic data from the UK Household Longitudinal Study (UKHLS) 2018 to 2019. In total 18'321 adults in the UK were included in the study, of which 1'474 (11.8%) were young people aged between 16 and 24. During the first wave of the pandemic in May 2020, the mean score of the General Health Questionnaire (GHQ-12) peaked for the whole population at 12.9 but was most pronounced among those aged 16 to 24 years. In June 2020, an improvement

was observed, but the pre-pandemic level was not reached anymore. Initially, enjoyment of day-to-day activities showed the strongest impact of the pandemic. Other items indicating effects of the pandemic were: loss of sleep, feeling under strain, and feeling unhappy and depressed. Five trajectories emerged for mental health in a latent class analyses by using the longitudinal data. For young people aged between 16 and 24, the following five distributions were found in the trajectories: consistently very good ($n = 532$; 7.9%), consistently good ($n = 627$; 13.2%), recovering ($n = 164$; 15.0%), deteriorating ($n = 99$; 16.2%), and consistently very poor ($n = 52$; 15.6%). The group with deteriorated mental health was more likely to be female, younger, (aged 16 to 35), Asian, without a partner, and with a previous mental illness. Participants in the group with consistently very poor mental health were more likely than the general population to be of mixed ethnicity, female, living in seclusion, living in disadvantaged deprived neighborhoods, having no partner, and having previous mental illness. Individuals living in a deprived neighborhood, isolating themselves from others for health reasons, and reporting a prior mental illness were significantly more likely to be affected whose mental health status worsened between April and October 2020.

O'Connor et al. (2021) investigated the trajectory of mental health and well-being during the first 6 weeks of lockdown in 3'077 adults in the UK. Suicidal ideation increased over time, with respondents at wave 2 (9.2%; $OR = 1.17$, 95% CI [1.01, 1.34], $p = .031$) and wave 3 (9.8%; $OR = 1.24$, 95% CI [1.07, 1.44], $p = .005$) reporting higher levels than at wave 1 (8.2%). The difference between waves 2 and 3 was not statistically significant. 21% of the participants were above the cut-off point for moderate or severe levels of symptoms of anxiety at wave 1. However, these symptoms decreased across waves, with wave 2 (18.6%; $OR = 0.89$, 95% CI [0.81, 0.97], $p = .012$) and wave 3 (16.8%; $OR = 0.82$, 95% CI [0.74, 0.90], $p < .0001$) being lower than wave 1 (21%). Again, the differences between wave 2 and 3 were not significant. Subgroup analyses showed that women, young people (18–29 years), those from more socially disadvantaged backgrounds and those with pre-existing mental health problems have worse mental health outcomes during the pandemic across most factors.

A Norwegian cross-sectional study investigated the well-being, emotions and COVID-19 related attitudes of 87 elementary children (42 boys, 45 girls; $M_{age} = 9.66$ years, $SD = 1.77$) and their mothers ($M_{age} = 39.69$ years; $SD = 5.79$) after the shutdown of schools, shops and restaurants in June 2020. Results of the survey demonstrate that the well-being score (KIDSCREEN-10 index) in the sample ($M = 50.55$, $SD = 10.21$) was significantly lower than the published European norm of children aged 8-11 years ($M = 53.90$, $SD = 10.73$). Living in a one-parent household was associated

with lower child well-being, $p = .006$, and more negative emotions, $p = .005$, irrespective of mothers' income. Mothers' well-being was a significant predictor for children's well-being, $p = .001$, and children's negative emotions, $p = .039$, but not for children's positive emotions, $p = .235$. In terms of attitudes, children reported that the Corona virus had made their lives slightly worse ($M = 2.72$, $SD = 1.18$), $p = .033$. There was no association between family-level variables and children's attitudes towards COVID-19 and no association between children's attitudes towards the pandemic and their well-being or emotions. However, positive attitudes towards the COVID-19 related restrictions were associated with higher well-being, $r(87) = .30$, $p = .005$, and more positive emotions, $r(87) = .23$, $p = .035$, but not with negative emotions $r(87) = -.16$, $p = .133$. Overall, the results point to negative effects of the pandemic on children's well-being and emotions, but the effects were relatively small (Martiny et al., 2021).

Koenig et al. (2021) compared self-reported emotional and behavioral problems, depression, suicide thoughts and eating disorders in a matched sample of adolescents (12 to 20 years) in Germany using pre pandemic und lockdown data. This study did not find an impact of school-closings on adolescents mental health, with the exception that suicide plans decreased during the school closure ($OR_{adj} = 0.31$, 95% CI [0.13, 0.75], $p = .009$) and conduct problems (95% CI [-0.31, -0.00], $p = .045$). Family risk-factors did not moderate these finding. The influence of socioeconomic status on emotional and behavioral problems as well as depression decreased during the lockdown. These results do not support other findings showing an increase of mental health problems during the lockdown.

Gracia et al. (2021) compared the Catalonia Suicide Risk Code (CRSC) data from adolescents (12-18 years) during the first 12 months of the COVID-19 pandemic (March 2020 to March 2021) with data of the previous months (March 2019 to March 2020). The CRSC is a secondary suicide prevention program in Spain that provides a specialized follow-up care to reduce the likelihood of suicide re-attempt (SA). It also includes the registration of suicide attempts. During the pandemic, 690 adolescent SA were registered, representing a 25% increase in SA when compared to the previous year, when only 552 SA were registered. While SA did not change in boys (32.1-32.3/100.000), in girls, they increased substantially (from 99.2 to 146.8/100.000). In the starting school period (September 2020 to March 2021), the increase reached 195% (74.3 to 219.3/100.000). The annual increase in SA among girls was significantly higher in the COVID-19 year than in the pre-COVID-19 year ($p < .001$). For Boys, no differences between the years were found ($p = .825$).

Hu and Qian (2021) examined the mental health impact of the COVID-19 pandemic on adolescents (10 to 16 years) in the United Kingdom in July 2020. The study is part of a longitudinal study. Emotional problems (95% CI [0.09, 0.38]; $p = .002$) and peer relationship problems (95% CI [0.15, 0.40]; $p < .000$) increased and conduct problems decreased (95% CI [-0.30, -0.07]; $p = .002$). Adolescents with better-than-median mental health before the pandemic have experienced an increase in their emotional problems (95% CI [0.88, 1.22]; $p < .001$), conduct problems (95% CI [0.16, 0.39]; $p < .001$), hyperactivity (95% CI [0.46, 0.82]; $p < .001$), and peer relationship problems (95% CI [0.79, 1.08]; $p < .001$), and they have also become less prosocial (95% CI [-1.03, -0.75]; $p < .001$). In contrast, adolescents with worse-than-median mental health before the pandemic have experienced opposite changes in each Strengths and Difficulties Questionnaire domain. Boys have experienced a smaller increase in emotional problems but a greater decrease in prosocial tendency. The negative mental health impact is particularly prominent among adolescents in one-parent, one-child, and low-income households. Adult household members' COVID-19 symptoms and illness were also found to undermine adolescents' peer relationships.

An Italian study from Uccella et al. (2021) aimed to investigate the impact of COVID-19 on the behavior and coping strategies of families. Between March 23rd and April 4th, 2020, a total of 6'800 participants answered the exploratory cross-sectional online survey. There was a total of 1'595 caregivers with children aged <6, and 2,265 caregivers with children aged 6-18. Caregivers with children with age <6 years had a higher COVID Threat scores compared to caregivers with children with age 6 to 18 years. 64.3% of parents of children <6 years and 72.5% of children between 6 and 18 years reported behavioral changes. The most reported changes in the <6 years group was increased irritability (34.7%), followed by sleeping problems, and separation anxiety. Regarding the group of the 6–18-year-olds, most reported change was in feeling of shortness in breathing (71.3%) followed by difficulties in falling asleep (48.6%) and waking up (33.2%). The pre-existing levels of psychological weaknesses, sleep habits, substance use and COVID-19 stress correlated with the reported behavioral changes in both age groups (all p 's < .0001).

A report from Revet et al. (2021) presents the main findings from the second questionnaire of the CovCAP longitudinal survey that was sent to the heads of academic on child and adolescent psychiatry (CAP) services. The target of the CovCAP survey was to analyze the impact of COVID-19 on CAP services in Europe. (First questionnaire was conducted in March/April 2020). Data was collected between February 19th and March 25th, 2021 in 32 different countries. A total of 60

participants answered the self-report online questionnaire survey. There was an increase in the perceived impact on the mental health and psychopathology of children and adolescents dramatically from “medium” (> 50%) in 2020 to “strong” or “extreme” (80%) in 2021. The number of referrals or requests for assessment also rose in 2021. Most impacted disorders were suicidal crises (83%), anxiety disorders (70%), eating disorders (64%) and major depressive episodes (61%). Regarding the interference of care provision, the analysis showed 59% reported only a minor impact (2020: 68% reported major impact). Thereby, the heads of the CAP departments expressed strong concerns regarding the management of the long-term consequences of this crisis, especially regarding the provision of care in light of the perceived increase in referrals.

In a cross-sectional observational study, Garcia-Adasme et al. (2021) examined the effect of COVID-19 related home confinement on the pediatric population in Spain. Between April 22nd and 26th, 2020, a total of 2'292 children with the maximum age of 17 years (<17 years: $n = 989$; <7 years: $n = 1,303$) participated. They answered a web-based anonymous questionnaire focusing on anxiety level, behavioral disturbances, and somatic symptoms. For children <7, parents reported. There was a significant difference in gender and the anxiety level in children aged 7 years or more. Male participants reported in all four categories sig. more anxiety than girls (TA: 53.2 vs. 42.6 ($p < .001$); PA: 42.9 vs. 37.8 ($p = .005$), R/H: 65.6 vs. 53.7 ($p < .001$); Sc/C: 47.5 vs. 39.2 ($p = .001$). Significantly high values were found in all aspects of anxiety among those who had trouble concentrating on homework, were worried about getting COVID-19 and were worried about their parents losing their jobs. Of the children below 7 years, a total of 56.3% reported four or more anxiety-related symptoms. The most frequent symptoms were: tantrums, emotional changes, excessive concern and fear of being alone.

A cross-sectional transnational online survey (Francisco et al., 2020) analyzed the psychological and behavioral symptoms associated with COVID-19 quarantine in children and adolescents. Data was collected from 1'480 parents of children between 3 – 18 years ($M = 9.15$, $SD = 4.27$) from Portugal, Spain, and Italy during 15 days between March and April 2020. The daily use of screens during quarantine increased during the quarantine ($p < .001$), with the proportion of children with >180 min/day usage increasing from 3.5% to 30.1%. The mean number of hours of sleep also increased significantly during weekdays during home confinement compared to before the quarantine. Complementary, there was a significant decrease in physical activity ($p < .001$) and the proportion of children who were less than 30 min per day physically active increased from 12.8% to 53%. Not having an outdoor exit at home was significantly correlated with sleep ($p < .001$).

Essau and de la Torre-Luque (2021) analyzed adolescent psychopathological profiles and explored its role in predicting the outcome of COVID-19. The sample for this study was drawn from the Millennium Cohort Study (MCS). Between January 2018 to March 2019 and in May 2020, a total of 904 participants completed mental health questions (2018-2019) and a COVID-19 survey (2020). The adolescents were at t1 17 years ($M = 17.18$ years) and at t2 19 years ($M = 19.17$ years) old. Based on the MCS sweep 7, four psychopathological profiles were identified. 60.17% of sample belonged to the profile which consisted adolescents with low levels of psychological symptoms. The second profile included adolescents with the highest risk of showing almost all the psychological symptoms and problematic behaviors (23.01% of sample). 12.03% of sample belonged to the third profile, which comprised adolescents at high risk of substance use and behavioral addictions. Lastly, the fourth profile included adolescents who reported having bad sleep quality and mental health difficulties, and symptoms indicative of poor emotion regulation (4.79% of sample). The following six covariates with significant loading ($p < .05$ for all the covariates) explained the mental health outcomes: sex, social support, loneliness, changes in perceived stress and conflict levels, and psychopathological class membership. Higher mental distress (6.64**), higher anxious (6.89**) and depressive symptom levels (4.39*), and lower levels of mental well-being (-4.47**) were associated with being a woman. Having higher levels of social support was associated with less mental distress (-3.27**), and higher mental well-being (5.93**). Loneliness was associated with an increase in mental distress (14.44**), a reduction in mental well-being (-13.18**) and a rise in depressive symptoms (8.38**). The change in perceived stress was correlated to mental distress (8.66**) and reduced mental well-being (-7.30**). Similarly, also a change in conflict level was associated with higher mental distress (3.28**), higher anxious (3.32**) and depressive symptom levels (4.35**), and lower mental well-being (-3.60**).

Berasategi Sancho et al. (2021) analyzed the well-being of children during a period of full lockdown in Spain. The scale "Well-being of Children in Lockdown" (WCL) was used to measure wellbeing of 1'225 children from 2–12 years in Basque Country during the 6 week home confinement. The survey was completed by the parents and the dimensions ranked on a 4 point Likert scale from 1 = strongly disagree to 4 = strongly agree. Regarding overall well-being, the mean score was between disagree and agree ($M = 2.89$). Most parents think that their child cries more than usual (93.9%), feels more nervous than usual (89.8%), gets angry more than usual (87.1%) and feels sadder than usual (94.9%). In contrast, many also think that their child is happy (58.2% sometimes and 24% frequently). Girls show higher overall well-being and emotions scores as well as more playful and

creative as well as physical activities than boys ($p = .002$, $p = .013$, $p = .001$, $p = .027$). Additionally, younger children (2–6 years) show higher scores for general well-being ($p = .001$), for playful and creative activities ($p = .001$), and physical activities ($p = .001$). Scores for all domains were also higher for children who have access to an outdoor space (general well-being ($p = .001$)). Study findings demonstrate that girls, younger children and those who have access to an outdoor space show the greatest levels of well-being during lockdown.

Holzer et al. (2021) investigated students' basic needs and well-being during COVID-19. They focused on positive emotion, intrinsic learning motivation and the moderating role of self-regulated learning (SRL). The first data collection took place in Austria. Between April 7th and 24th, 2020, a total of 19'337 children between 10 and 21 years ($M = 14.56$ years, $SD = 2.49$ years) answered the online questionnaires. From May 5th to 11th, 2020, a follow-up study was conducted in Germany, in which 630 children between 10 and 21 years ($M = 15.73$ years, $SD = 2.76$ years) participated. In both studies, positive emotions were significantly positive associated with the three basic needs of competence, relatedness, autonomy as well as SRL. Moreover, competence (both $ps = <.001$) and autonomy (both $p's = <.001$) were positively associated with intrinsic learning motivation. Regarding relatedness, there was a small negative association with intrinsic learning motivation.

The cross-sectional study from Akgül and Atalan (2021) analyzed the anxiety levels of adolescents during COVID-19. Further, they assessed the impact of parental cyberchondriasis and adolescents' emotion regulation on anxiety symptoms. A total of 155 adolescents between 12 and 18 ($M = 14.63$, $SD = 2.04$ years) and their parents ($N = 155$) participated in the study. The time frame of the data collection is not specified. Parents and children answered the survey questions independently. The means of the anxiety levels for both, adolescents and parents, in this study were higher than the norm values (as stated by Spielberger et al., 1983). Girls had higher anxiety level than boys ($p < .001$). After controlling for adolescents' gender and emotion regulation, parental cyberchondriasis and anxiety accounted for a substantial amount of variance in adolescents' anxiety. Higher parental anxiety ($\beta = .55$, $p < .001$) and compulsion ($\beta = .22$, $p < .001$) were associated with higher anxiety levels in adolescents. Increased parental distress ($\beta = -.21$, $p < .001$), however, was associated with lower anxiety. The more adolescents used the internet to regulate their emotions, the higher were their anxiety levels ($\beta = .25$, $p < .001$).

The Turkish study from Arslan (2021) analyzed the mediating effect of mindfulness on the association of coronavirus-related suffering and stress with death obsession and subjective

wellbeing in young adults during COVID-19. A total of 583 students between 18 and 40 years ($M = 20.97$) participated in the web-based online survey (time frame unknown). Whereas coronavirus suffering ($r = 0.27$; $p < .01$) and coronavirus stress with death obsession ($r = 0.28$; $p < .01$) were positively associated, mindfulness and subjective wellbeing were negatively associated with coronavirus suffering and stress ($r = -0.32$, $p < .01$ and $r = -0.26$, $r = -0.23$; $p < .01$). Mindfulness was positively correlated to subjective wellbeing ($r = 0.24$; $p < .01$), suggesting that it can be classified as a protective factor for adolescents mental health.

A cross-sectional study from Beisland et al. (2021) focused on associations between quality of life and fear of COVID-19. The data sample included 2'605 nursing students (18–25 years: 1'846; 25–29 years: 377; ≥ 30 years: 382) from Norway. The data was collected with an electronic questionnaire between January 27th and February 28th, 2021. The analysis showed that the scores in the Fear of COVID-19 Scale (FCV-19S) were higher than those of the reference population ($p < .001$). Nursing students scores showed significantly lower general health (Cohen's $d = 0.07$), higher levels of psychological distress (Cohen's $d = 0.55$) and lower overall QoL (Cohen's $d = 1.16$) compared to pre-pandemic reference data. FCV-19S scores were significantly associated with levels of general health (Cohen's $d = 0.26$), psychological distress (Cohen's $d = 0.76$) and overall QoL (Cohen's $d = 0.18$).

In a cross-sectional study, Engel de Abreu et al. (2021) examined the well-being of adolescents during the first wave of the COVID-19. A total of 1'515 (between 10 and 16 years old) adolescents from Luxembourg, Germany, and Brazil completed an online, self-report questionnaire. The survey was available between May 6th and July 14th, 2020. In all three countries, emotional well-being was predicted by gender (coefficient: Luxembourg = -0.17 ; Germany = -0.14 , Brazil = -0.11), life satisfaction before the pandemic (coefficient: Luxembourg = -0.28 ; Germany = -0.10 , Brazil = -0.15), fear of illness (coefficient: Luxembourg = 0.40 ; Germany = 0.33 , Brazil = 0.42), satisfaction with freedom (coefficient: Luxembourg = -0.25 ; Germany = -0.43 , Brazil = -0.27), difficulty/quantity of schoolwork (coefficient: Luxembourg = 0.19 ; Germany = 0.18 , Brazil = 0.24), passive activities (coefficient: Luxembourg = 0.23 ; Germany = 0.25 , Brazil = 0.24), cultural possessions (coefficient: Luxembourg = -0.12 ; Germany = -0.10 , Brazil = 0.10), and satisfaction with the way adults listen (coefficient: Luxembourg = -0.17 ; Germany = -0.19 , Brazil = -0.16). Lower levels of subjective well-being during the pandemic were associated with being a girl, having fewer cultural possessions, and having had a lower life satisfaction before the pandemic. Life satisfaction in all three countries was predicted by satisfaction with freedom during the pandemic (coefficient: Luxembourg = 0.18 ;

Germany = .17, Brazil = .24), content of schoolwork (coefficient: Luxembourg = .42; Germany = .57, Brazil = .44), and the satisfaction with the way adults listen during the pandemic (coefficient: Luxembourg = .34; Germany = .19, Brazil = .25).

A German study from Calvano et al. (2021) focused on the analysis of parenting during the COVID-19. The data collection took place between the August 3rd and 11th, 2020. A total of 1'024 parents ($M_{\text{age}} = 41.70$ years, $SD = 8.37$ years) of underage children ($M_{\text{age}} = 9.41$ years, $SD = 4.78$ years) participated in the study (computer-assisted telephone interviews: 402 participants; computer-assisted web survey = 622 participants). Parents felt most stressed by the social distancing from family and friends (56.1%), followed by the closure of schools (55.9%) and the closure of childcare (52.1%). Compared with pre-COVID-19 levels, the parental stress level was significantly higher than during COVID-19 ($p < .001$; small effect size of $d = 0.21$). There was a moderate correlation found between pandemic-related stress and parental outcomes. A total of 6.5% of parents reported on their children's lifetime occurrence of severe stressful life experiences. 29.1% reported an increase in witnessing domestic violence, 42.2% verbal emotional abuse. The two most affected adverse childhood experiences domestic violence and verbal emotional abuse go hand in hand with higher parental stress ($d = 0.72$ respectively $d = 0.88$), job losses, and younger parent and child age.

A longitudinal study from Italy (Alivernini et al., 2021) assessed positive and negative affect in adolescents, using the Positive and Negative Affect Scale for children (PANAS-C) as a standardized instrument. Affects was measured one year before the COVID-19 pandemic as well as at the end of the lockdown in May and June 2020. The results indicated a reduction of levels of positive affect and increases in the levels of negative affect (both $p < .001$).

Beutel et al. (2021) conducted a representative face-to-face survey on mental health and loneliness with 2'503 participants from Germany between May 2nd and June 29th, 2020. Although lockdown measures were successively being reduced during this time, most schools and childcare facilities remained closed and large-scale events such as parties, sports events, movies, and concerts were prohibited. The authors compared the 2020 data with an earlier study from 2018. Overall, symptoms of depression and anxiety increased in 2020 compared to 2018, but not symptoms of loneliness. Younger participants aged 14 to 29 (2018: $n = 466$; 2020: $n = 563$) showed the largest increase in symptom levels for depression, anxiety, and loneliness, relative to participants aged 30 to 59 years, as well as participants aged 60 to 95 years. Thereby, young women displayed the largest change

with symptom increases between 50 and 70 percent. However, the increase in participants who fulfilled the criteria for clinically significant depression symptoms (11.6% in 2020 vs. 7.5% in 2018) or anxiety symptoms (11.1% in 2020 vs. 8.3% in 2018) did not change to a large degree. The strongest predictor for depression and anxiety in 2020 were low household income and unemployment followed by female sex, lack of partner, and migration background. Age was not significantly associated with depression symptoms but female sex was related to high levels of depression symptoms. In terms of loneliness, low household income and lack of a partnership were the strongest predictors followed by female sex and unemployment. In addition, female sex was associated with higher levels of loneliness. Importantly, many of the risk factors that were assessed such as the lack of a partnership or a low household income applied to the younger participants aged 14 to 29.

This cross-sectional study from Turkey (Zengin et al., 2021) aimed to analyze the effects of COVID-19 on children's lifestyles and anxiety levels. Between May and June 2020, 309 children between the ages of 9 and 12 ($M = 10.3$ years; $SD = 1.2$ years) completed an online survey with help from their parents. The majority of the children was aware of the COVID-19 pandemic. 91.9% reported that the pandemic had an important effect on their lifestyle. Increasing age was associated with decreasing state anxiety levels and increasing trait anxiety levels. There was a significant relationship between the state anxiety levels and the age ($p = .002$). While the reported state anxiety levels of boys were significantly higher than those of girls ($p = .007$), trait anxiety levels did not differ between genders. Children who said that there was no one to play with and who could never contact their friends since the pandemic were found to report higher levels of trait anxiety. Children who said they play more creative games at home and that they could easily contact their friends on the Internet reported higher levels of state anxiety.

Ravens-Sieberer et al. (2021) conducted the COPSY study to investigate the impact of COVID-19 on the psychological health of children and adolescents between 7 and 17 years in Germany. The authors compared the data with the BELLA study (Behavior and wellbeing of children and adolescents in Germany study). Between May 26th and June 10th, 2020, $n = 1'040$ children aged 11 to 17 years and parents of $n = 546$ children aged 7 to 10 years completed the online survey. The following variables were measured: health-related quality of life, mental health problems, anxiety, and depression. With 70.7%, the majority of the participants between 11 and 17 years reported that COVID-19 was a burden. The percentage of 11 to 17-year-olds who experienced lower health-related quality of life increased from 15.3% before COVID-19 to 40.2% during COVID-19 ($p < .001$).

Thereby, girls reported more often a low health-related quality of life during COVID-19 than boys (44.7% vs. 35.7%, respectively). Moreover, younger children were affected more than older ones; with an increase from 7.7% to 41.3% in 11- to 13-year-old children and from 17.1% to 39.3% in 14- to 17-year-olds ($p < .001$). According to parent proxy-reports, mental health problems increased from 9.9% before COVID-19 to 17.8% during COVID-19. With an increase from 7.4% to 26.8%, children between 7 and 10 were more affected than children between 11 and 13-year-olds who showed an increase from 12.8% to 14.5% ($p < .001$). During the pandemic considerable rates were also found for parent-reported hyperactivity (14.6%), emotional problems (13.3%), peer problems (11.5%) and conduct problems (10.0%). Based on self-reported data of 11- to 17-year-olds, the children and adolescents experienced higher levels of generalized anxiety during the COVID-19 pandemic (24.1%) compared with before the pandemic (14.9%). The children and adolescents also self-reported depressive symptoms: 62.1% had trouble concentrating, 58.4% had little interest or joy in activities, and 33.7% felt sad. Surprisingly, no significant increase was found in the prevalence of depressive symptoms before vs. during the pandemic ($p > .05$).

A longitudinal study in Italy, Spain, and Portugal (Orgilés et al., 2021) investigated the psychological reactions to the pandemic two, five, and eight weeks after the lockdown in 2020. Parents completed the "Impact Scale of COVID-19 and Home Confinement on Children and Adolescents". Country differences were found, but overall anxiety ($OR = 3.78$; 95% CI [2.90, 4.91], $p \leq .001$), mood symptoms ($OR = 1.95$; 95% CI [1.61, 2.35], $p = .005$), sleep disturbances ($OR = 1.49$; 95% CI [1.30, 1.70], $p \leq .001$) and behavioral disturbances ($OR = 1.17$; 95% CI [1.08, 1.27], $p \leq .001$) and cognitive disturbances ($OR = 1.45$; 95% CI [1.21, 1.73], $p \leq .001$) significantly increased from two weeks after the lockdown (Time 1) to five weeks (Time 2). From five to eight weeks (Time 3), almost all psychological reactions decreased with the exception of anxiety. Parental stress was related to all children's psychological symptoms, except for eating disturbances.

A study from Norway (Larsen et al., 2021) used data from a longitudinal study (FamilieForSK) to analyze the influence of COVID-19, specifically home schooling and social isolation, on children's emotional, somatic/cognitive and worry reactions. The authors analyzed data from the third wave (April 1st to May 25th, 2020). A total sample of 442 participants ($M = 11.43$ years) completed the online survey or interview. Children reported fewer emotional reactions compared to before but more somatic/cognitive reactions, both p 's < 0.01 . Home school experience, missing friends, worry about virus infection, child perceived family stress and instability but not screen time use are associated with children's emotional, somatic/cognitive and worry reactions. Thereby, children's

perceived family stress and instability appeared to be the strongest predictor of child reactions, explaining 20.7 and 44.1% of the variance in outcomes.

The psychological impact of the quarantine-induced stress during COVID-19 among Italian athletes was examined in a study by Di Cagno et al. (2020). Children from 8 to 12 years ($n = 338$) and adolescents from 13 to 17 years ($n = 499$) completed the self-administered questionnaire "Impact of Event Scale" (for children: IIES-8; for adolescents: IES-15) between April 1st and May 4th, 2020. 53.55% of the children reached a higher IIES-8 score than the cut-off, indicating a high risk for a potentially traumatic event. The majority (68.32%) of the adolescents scored lower than the cut-off. There were no significant differences in children and adolescents for gender, geographic area, type of sport, and competitive level. The analysis of children showed a significant difference ($p = .020$) between competitive levels for symptoms of intrusion (e.g., recurring thoughts, images, dreams, and feelings of traumatic experience-related events), with higher results scores in elite relative to amateur athletes. The analysis of adolescents showed significant differences ($p = .011$) between gender for avoidance (e.g., attempts to remove actively from consciousness thoughts and emotions associated with the traumatic experience; it is related to numbness and dissociation, such as active defensive reaction), with higher scores in males.

A cross-sectional cohort study in Italy (Mensi et al., 2021) investigated the COVID-19-related psychiatric impact on adolescence between April and June 2020 (i.e., with wide-ranging restrictions in place). Specifically, the study focused on (a) the prevalence rate and sociodemographic correlates of COVID-19-related post-traumatic stress disorder (PTSD) and COVID-19-related acute stress disorder (ASD), and (b) level of personal stress and of perceived parental stress, and connection with mental health. 1'262 adolescents between 12 and 18 years ($M = 16.27$ years; $SD = 1.63$) filled in an online questionnaire. The sample included 118 adolescents with psychiatric problems (APP+) and 1'144 adolescents without psychiatric problems (APP-). The majority of adolescents (79.52%) reported isolated COVID-19-related acute stress (29.48%) or posttraumatic stress (50.04%) symptoms. Factors like region of residence, personal or parental history of COVID-19 and living with or without parents was not related to the presence of COVID-19-related ASD and PTSD in adolescence. There was a significant relationship between the presence of COVID-19-related ASD and PTSD in adolescence and the alteration in the content of thought ($p = .03^*$), and to experience dissociative symptoms ($p = .02^*$). Adolescents with subthreshold COVID-19-related ASD

and PTSD symptoms referred the highest levels of personal stress and adolescents with psychiatric/psychological conditions experienced higher stress (11.7% vs. 10.0%; $p \leq .001^{**}$).

A longitudinal study in the Netherlands (Green et al., 2021) investigated mood fluctuation during the pandemic in adolescents (10 to 20 year-olds) and young adults (21 to 25 years) that were recruited via high schools and college. Relative to older adolescents, younger adolescents showed higher levels of vigor and lower levels of tension and depression in both May 2020 and November 2020. From May to November 2020 feelings of vigor decreased ($p = .021$), while feelings of tension ($p < .001$) and depression ($p = .006$) increased, particularly among younger adolescents. Furthermore, the analyzes yielded evidence for a link between vulnerability factors (i.e. family stress and inequality of opportunity in online homeschooling) and instability in negative affect (i.e. tension and depression fluctuations) during the first months of the pandemic. These findings demonstrates that during the COVID-19 pandemic, young people' s vulnerability with respect to their mood and emotional reactivity increased, particularly for adolescents who experienced more stressors.

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 8th and 24th, 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 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, 95% CI [1.55, 2.46]) and fewer children reported poor global health (RR = 0.36, 95% CI [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.

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]; $OR = 4.93$, 95% CI [2.24, 10.87]; $OR = 1.87$, 95% CI [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 ($OR = 2.09$, 95% CI [1.82, 2.40] and $OR = 1.70$, 95% CI [1.47, 1.96], respectively). Older age ($OR = 0.44$, 95% CI [0.33, 0.59] for those aged 45 to 54 years) and higher baseline weekly household earnings ($OR = 1.08$, 95% CI [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, Bühler, 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, 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, $p < .001$.

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 negative 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 21st to June 4th, 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 ($r_{pb} = .14$, $p < .001$) and whether the baby's birth was before or during COVID-19 ($r_{pb} = .09$, $p < .005$). Moreover, impaired mother–infant bonding was positively and significantly associated with anxious symptoms ($r = .28$, $p < .001$), depressive symptoms ($r = .36$, $p < .001$), and parenting stress ($r = .66$, $p < .001$) (Fernandes et al. 2021).

An exploratory study from Italy (Cerniglia et al., 2021) examined the influence of the pandemic on the quality of mother-child exchanges during feeding in a sample of mothers and children ($N = 359$), along with children's emotional behavior. To this aim, the Child Behavior Checklist (CBCL-1,5-5) was administered in the pre-pandemic period (May 2019; T1) and during the COVID-19 lockdown (Nov 2020; T2). Children were 18 months old at T1 and 36 months at T2. Results show that children's emotional/behavioral functioning was rated by mothers as more maladaptive at T2, especially in the subscales of Withdrawn, Anxious/Depressed and Aggressive Behavior (all p 's $< .001$). Children also showed significantly higher scores in the Internalizing and Externalizing Subscales from T1 to T2 (both p 's $< .001$). According to these results, children's emotional behavior have become more maladaptive during the pandemic. Moreover, the quality of mother-child interactions decreased significantly from the pre-pandemic period to the lockdown period.

This population-based prevalence proportion study from Spain investigated if there is a link between the lockdown and changes in preterm births and stillbirths. The authors analyzed data from January 2015 to June 2020. A total of 70,024 births and 68,998 infants were included. There was no decrease in preterm proportions during the lockdown period with respect to the whole pre-lockdown

period or to the pre-lockdown comparison periods (2015–2019): 6.5% (95% CI [5.6, 7.4]), 6.6% (95% CI [6.5, 6.8]), and 6.2% (95% CI [5.7, 6.7]). Stillbirth rates among the different study periods found did not change significantly: 0.33% (95% CI [0.04, 0.61]) during the lockdown period vs. 0.34% (95% CI [0.22, 0.46]) during the pre-lockdown comparison period (2015–2019). The authors did not find any link between prematurity and lockdown, nor between stillbirths and lockdown. (Arnaez et al., 2021)

Christner et al. (2021) tried to capture lockdown-related effects on German parents and their 3–10 years olds ($N_{\text{Parents}} = 2.672$, $N_{\text{Children}} = 3389$). "Older Children (7–10 years) evidenced more emotional symptoms as well as less conduct problems and hyperactivity than younger children (3–6 years). Children's own and their parents' stress level, the degree to which children missed other children, and children's age all showed to be negatively related to children's general life satisfaction. Children's emotions, moods, and their general satisfaction turned lower or more negative since the start of the pandemic and the associated restrictions, p 's < .001, d s range from 0.35–0.41. On the other hand, children's free time and family life turned more positive, p 's < .001, d s range from 0.24–0.54. Single parenthood and being an only child were associated with higher levels of child problems. Likewise, only children showed more emotional symptoms and hyperactivity/inattention than children with siblings. Less hyperactivity/inattention was reported for children living in a house ($M = 4.01$, $SD = 2.29$) compared to children living in an apartment ($M = 4.38$, $SD = 2.33$). Children, who had a large garden at home, showed less hyperactivity/ inattention ($M = 3.93$, $SD = 2.27$) and less conduct problems ($M = 3.23$, $SD = 2.10$) compared to children without a large garden (hyperactivity/inattention: $M = 4.32$, $SD = 2.33$; conduct problems: $M = 3.38$, $SD = 2.15$). Parental education related negatively to all aspects of children's problem behavior."

An Italian study by Spinelli et al. (2021) investigated the influence of COVID-19 on parenting stress and in turn the effect on children emotional well-being / children's emotion regulation from families with different socioeconomic risks. A total of 810 parents filled out the online questionnaire, which was available from April 2nd to 7th, 2020. Quarantine parent-risk index ($r = -.12^{**}$), household chaos ($r = -.30^{**}$), parent involvement ($r = .31^{**}$), parenting stress ($r = -.43^{**}$) and the dysregulation of negative emotions ($r = -.40^{**}$) all correlated with emotion regulation. There was a difference in perceiving stress during COVID-19 between the socioeconomic at-risk parents and socioeconomic no-risk parents. "Parents in the no-risk group reported more difficulties in dealing with lockdown strengths, and, only for them, those constraints affected parenting stress. Higher levels of parenting stress were directly associated with reports of more children emotion regulation problems. Parents

reporting higher levels of stress were less engaged with their children, they were less interested in children emotional well-being, they paid less attention to the child, and in general spent less time with the child, despite the lockdown imposed parents and children to spend the whole day at home. This lack of involvement, in turn, exacerbated child emotion regulation problems. For the not at-risk group, parental involvement mediated the impact of parenting stress on children's emotion regulation competences, but not on children's negative emotionality. In the socioeconomic at-risk group parental involvement played a protective role on children's emotion negativity."

In the UK; Cooper et al. (2021) used data from the Covid-19: Supporting Parents, Adolescents and Children during Epidemics (Co-SPACE) study to explore the association between loneliness, social relationships, and mental health in adolescents. Self-reported data from 894 young people (age 11 to 16) were used. The data was collected at two timepoints, baseline (March, 30th 2020 and June, 1st 2020) and one month later the first follow up. Overall being female, $r(867) = .19, p < .001$, and being older, $r(867) = .13, p < .001$, and lower income, $r(804) = .08, p < .05$, was associated with being lonely. Higher loneliness was significantly associated with higher scores on all mental health measures (emotional symptoms, conduct problems, hyperactivity-inattention, and psychological stress). Psychological stress and loneliness were strongly associated, $r(866) = .51, p < .001$. The time someone spent talking to other people was not related to mental health or loneliness. But there was a small positive association between "texting others" and conduct problems, $r(874) = .15, p < .001$, hyperactivity-inattention, $r(874) = .08, p < .05$, and psychological distress, $r(869) = .09, p < .05$. However, there was no significant association between "texting others" and loneliness. It was "concluded that while loneliness was associated with greater mental health difficulties at baseline, it did not predict increased mental health difficulties one month later.

Chen, Osika et al. (2021) measured the impact of COVID-19 on 15-year-old adolescents (baseline age 13.6 ± 0.4 years) in Sweden. 1317 adolescents filled in the baseline measurement in 2018 and the 2-year follow-up survey before February 1st, 2020 (i.e., before the COVID-19 pandemic) and 584 filled in the baseline measurement in 2018 and the 2-year follow-up survey after February 1st, 2020 (i.e., after the onset of the COVID-19 pandemic). Compared to baseline, all adolescents reported higher levels of stress and psychosomatic symptoms and lower levels of happiness at follow-up. However, there were no differences regarding the changes in the mental health outcomes over the course of the 2 years between the COVID-19-exposed group and the adolescent group that filled in both measurements before the COVID-19 pandemic, suggesting that the changes are age-related rather than COVID-19-related. However, this might be explained by the fact that

Swedish schools were open throughout the data collection which allowed adolescents to keep in touch with their social contacts.

Scarpellini et al. (2021) explored the experiences in organizing school for children at home and its implications on children's psychological well-being. A cross-sectional, observational study using an online questionnaire was conducted from May 8th to 15th, 2020. It targeted mothers of children aged 6 to 15 years old ($N = 1601$). Most mothers (60.2%) reported behavioral changes in their children, particularly in the youngest ($OR = 1.39$, 95% CI [1.11, 1.73]). The most frequently reported symptoms were restlessness (69.1%) and aggressiveness (33.3%) in the youngest and anxiety (34.2%) in the oldest. The level of restlessness and aggressiveness was higher in primary school children compared to middle school children ($OR = 1.72$, 95 % CI [1.26, 2.44]; $OR = 1.50$, 95% CI [1.06, 2.10]).

A Spanish study (Pizarro-Ruiz & Ordóñez-Cambor, 2021) indicates that a strict confinement situation of 8 to 10 days already has significant consequences for the mental health of children and teenagers. They had increased problems in rebellious behavior, ($d_z = 0.75$), rage control ($d_z = 0.61$) and emotional regulation ($d_z = 0.27$). According to the Awareness of the Problems of the Assessment System for Children and Adolescents (SENA) scale, children did not clearly identify these altered conditions in themselves, and it is frequent that symptoms like irritability or aggression appear as a warning signal of more chronic disorders for this age group. Children and teenagers also showed higher levels of anxiety ($d_z = 0.14$), depression ($d_z = 18$), and less integration and social competence ($d_z = 16$), although with lower effect sizes. In children, somatic complaints were improved. In teenagers, girls showed less self-esteem and more anxiety, problems of emotional regulation, and somatic complaints than boys, while the boys showed lower levels of social integration and social competence.

A population-based study from Iceland (Thorisdottir et al., 2021) assessed depressive symptoms during the Covid-19 pandemic with the Symptom Checklist-90 and mental wellbeing with the Short Warwick Edinburgh Mental Wellbeing Scale in a sample of 13 to 18 year-olds. A total of 59'701 survey responses were included in the analysis. Results show an increase in depressive symptoms ($\beta = 0.57$, 95% CI [0.53, 0.60]) and worsened mental wellbeing ($\beta = -0.46$, 95% CI [-0.49, -0.42]) in 2020 across all age groups compared to the same-aged peers before the pandemic. These results were significantly worse in female participants compared with male participants ($\beta = 4.16$, 95% CI [4.05, 4.28], and $\beta = -1.13$, 95% CI [-1.23, -1.03], respectively).

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

Baier and Kamenowski (2020) from the Zurich University of Applied Sciences conducted a cross-sectional study on how adolescents in the canton of Zurich experienced lockdown – in particular the school closures – due to COVID-19. 1103 adolescents aged between 12 and 20 years ($M_{\text{age}} = 15.5$ years) filled in an online questionnaire between April 23rd and May 19th, 2020. Information on the behaviors and activities before the lockdown was retrospectively assessed. The mean score for life satisfaction decreased from 3.14 before the school closure to 3.08 for the time of the survey ($p < .05$). Among students who reported being "very satisfied" with their lives, there was a significant decrease from 33.9% to 28.3% ($p < .001$). Time spent on screen media (for example movies, internet or computer games) has increased by almost two hours per day: Before the school closures, the participants spent an average of 3:47 hours on screen media, while during the lockdown it was 5:38 hours. A decrease was observed in all categories of substance consumption: while 45.5% of the participants drank alcohol before the lockdown, only 39.8% did so during the school closures ($p < .001$). For cigarette use, the rate decreased from 13.7 to 11.1 % ($p < .01$) and for other drugs from 13.7 to 9.5 % ($p < .001$). For sexual cyberbullying, there are no changes in prevalence rates, but psychological cyberbullying, on the other hand, has decreased: before the school lockdowns, 11.0% reported psychological cyberbullying, while decreased to 8.2% ($p < .01$) during the lockdown. The proportion of participants reporting high levels of affection from the parents increased from 53.0% to 66.7% ($p < .001$); In addition, there is a slight decrease in the percentage of respondents who experienced parental violence (from 10.2 to 8.8%; $p < .05$).

Troncone et al. (2020) explored in their cross-sectional study the prevalence of disordered eating behaviors (DEBs) in a sample of Italian children and adolescents with type 1 diabetes (T1D) and in matched-pair healthy controls during the COVID-19 lockdown. 138 children and adolescents with T1D and 276 age- and gender-matched healthy peers voluntarily completed an online survey about eating behaviors (ChEAT and EAT-26), anthropometric characteristics, and clinical characteristics. Results show that 8.69% ($n = 12$) of participants with T1D and 13.4% ($n = 37$) of controls had ChEAT/EAT-26 scores indicating presence of DEBs, with no differences between patients – whether children (total ChEAT score $p = .75$) or adolescents (total EAT-26 score $p = .73$) – and healthy peers. Investigators argued that due to home confinement, parents may monitor their children's behavior throughout the day, preventing unhealthy conduct and exhorting them to better meet diabetes rules. Girls had significantly higher ChEAT/EAT-26 scores than boys on all of the

ChEAT/EAT-26 subscales (Dieting, Oral Control, Bulimia and Food Preoccupation, Total score, all $ps = .047$).

A cross-sectional study by Benschop, van Bakkum & Noijen (2021) investigated changing patterns of substance use during the coronavirus pandemic in the Netherlands. An anonymous web survey was shared with a convenience sample ($N = 6070$, 64,4% adolescents 16-24 years) via social media and other channel to explore and describe changes in substance use during the lockdown in spring 2020. Within all subsamples current prevalence rates are lower compared to "pre-corona". Underlying variation in changing patterns were detected, including discontinued (tobacco 10.4%, alcohol 11.3%, cannabis 16.3%, other drugs 30.4%), decreased (tobacco 23.0%, alcohol 29.1%, cannabis 17.4%, other drugs 20.7%), unchanged (tobacco 30.3%, alcohol 21.2%, cannabis 22.3%, other drugs 17.3%), increased (tobacco 29.6%, alcohol 32.1%, cannabis 32.9%, other drugs 25.3%), and (re)commenced use (tobacco 6.7%, alcohol 6.3%, cannabis 11.1%, other drugs 6.2%). For alcohol, decreased use was relatively more common among young adults (18-24 years) while increased use was more common among adults (25-39 years). For other drugs, current prevalence rates were lower than "pre-corona" rates for ecstasy (65.4% vs. 78.9%, $p < .001$, Cohen's $g = 0.220$), amphetamines (30.2 vs. 38.7%, $p < .001$, Cohen's $g = 0.188$), nitrous oxide (36.0 vs. 52.2%, $p < .001$, Cohen's $g = 0.297$) and GHB (6.6 vs. 9.0%, $p = .007$, Cohen's $g = 0.211$), and only higher for 3-MMC/4-MMC (18.9 vs. 15.4%, $p = .003$, Cohen's $g = 0.171$). Regardless of how substance use has changed, the most given reason for current use of alcohol, cannabis or other drugs was either "Because I find it pleasant/fun/mind-expanding" ($p < .001$) or "Because I find it makes social moments more fun/cozy" ($p < .001$). Having fewer social occasions than "pre-corona" was the most important reason to discontinue or decrease other drug use (65.3%), followed by physical (26.1%), and mental (19.3%) health. Discontinued use was found to be much more common for other drugs than for tobacco, alcohol and cannabis, but for all substance types it was found that those who stopped using showed less extensive "pre-corona" consumption patterns. Overall, results show that people show varying changing patterns of substance use since measures came into effect and especially the use of drugs like ecstasy was discontinued or decreased due to the lack of social occasion.

In a longitudinal study from Spain, Rogés et al. (2021) aimed to identify the changes in binge drinking, hazardous drinking, hazardous consumption of cannabis and the daily smoking of tobacco during COVID-19. Additionally, they assessed risky consumption and the effect of individual and contextual factors. A total of 303 adolescents between 14 and 18 years participated in the study.

Data was collected before the start of the pandemic in Catalonia (October 2019 to February 2020) and after the lockdown in Catalonia (June to July 2020). The participants filled out the DESK-COVID-Cohort questionnaire, which included the AUDIT-C test (alcohol), CAST (cannabis) and questions regarding the use of tobacco. The analysis showed a significant reduction of binge drinking (36.3% to 5.9%, $p < .05$), hazardous drinking (38.9% to 5.6%, $p < .05$). and the hazardous consumption of cannabis (4.6% to 2.3%, $p < .05$) as well. "The overall prevalence of daily smoking decreased from 8.9% to 6.3% ($p < .05$)". Among specific groups (e.g. Vocational and Educational Training (VET) students) there was an increase of daily smoking. There were significant differences in the prevalence of risky consumption in different social groups. For instance, VET students had a significantly ($p < .05$) higher risk of substance use: binge drinking ($RR = 3.21$, 95% CI [1.00, 10.34]); hazardous drinking of alcohol ($RR = 3.75$, 95% CI [1.12, 12.54]), hazardous consumption of cannabis ($RR = 3.75$, 95% CI [0.65, 21.59]) and daily smoking of tobacco ($RR = 4.82$, 95% CI [1.74, 13.39]).

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 11th May and 26th 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 statistically 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).

The study from Akgül et al. (2021) in 64 adolescent patients with eating disorders (see sub-chapter on nutrition and eating behavior) followed during the past year at the Division of Adolescent

Medicine and the Department of Child and Adolescent Psychiatry investigated eating behavior during the age-stratified lockdown for those under 20 years in Turkey. 38 participants completed a survey on eating disorder behaviors, well-being and quality of life (QoL), including the eating disorder examination questionnaire (EDE-Q), scales for depression, anxiety and obsessive-compulsive behavior. Regarding the overall quality of life and health-related quality of life when considering the impact of their ED during the lockdown, results were similar. About one third of participants indicated bad QoL, for both overall and ED related QoL, one third reported good QoL for overall and ED related QoL, respectively, and one third was in between with their QoL ratings. According to the depression screening (BDI), 20 participants (52.6%) were at or above the cut-off point. Importantly, the study found that depression had the highest positive predictive value for eating disorder behavior. Thus, even in the early stages of the pandemic adolescents with ED were already reporting increased depressive symptoms.

With respect to alcohol abuse, a study from the UK (Niedzwiedz et al., 2021) observed that in 18–24-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).

A British Survey study (Skumlien et al., 2021) examined apathy and anhedonia in 372 adolescent cannabis users ($n = 200$) and controls ($n = 172$) before and during the COVID-19 pandemic lockdown. They observed that adolescent cannabis users had higher levels of anhedonia compared to age-matched controls and that cannabis dependence was associated with higher levels of apathy and anhedonia. They also found that levels of apathy and anhedonia had increased since the onset of the COVID-19 lockdown, and that this increase was larger in dependent compared to non-dependent cannabis users. With these negative impact of the lockdown on hedonic processing and motivation, the study suggests that adolescent cannabis users may be particularly vulnerable to experience mental problems during the pandemic.

A study on UK birth cohorts (Bann et al., 2021) provides data on alcohol consumption during the lockdown as compared to pre-lockdown data. The MCS cohort, born in 2001, showed a tendency to reduced alcohol consumption frequency.

A population-based study from Iceland (Thorisdottir et al., 2021), the frequency of substance use in 13 to 18 year-olds was assessed in the years 2016, 2018, and 2020. A total of 59'701 survey responses were included in the analysis. Results show significant decreases in cigarette smoking (OR 2.61, 95% CI [2.59, 2.66]) and alcohol intoxication (OR 2.59, 95% CI [2.56, 2.64]) among the 15- to 18-year-olds in 2020, as well as a reduction of e-cigarette use (OR 2.61, 95% CI [2.59, 2.64]) among 16 to 18 year-olds compared with 2016 and 2018.

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

In a paper on the impact of the lockdown on the psyche and media use in children and adolescent psychiatry, Werling, Walitza and Drechsler (2021a) refer to two studies conducted by them. They investigated how the lockdown affects the well-being of children and adolescents with psychopathological disorders and their media behavior. In the early summer of 2020, they ran an online survey at the children and adolescent psychiatry and psychotherapy Zurich (KJPP Zurich) with patients aged 10-18 years and their parents. The majority of parents (41%) indicated that there was no change in the main psychopathological problem during the lockdown, 21% of parents indicated a worsening and 38% an improvement. Patients with internalizing disorders had the highest percentage of improvement (44%). Daily media time (e.g., mobile phone, PC, tablet, game console, or TV) increased by 59% during the lockdown; for boys, time spent gaming increased most, while girls spent more time on social media. Parents reported almost no changes during the lockdown in digital problem and risk behavior (such as careless handling of personal data or cyberbullying)

Tromans et al. (2020) aimed to describe secondary mental health service utilization pre-lockdown and during lockdown within Leicestershire, UK, and the numbers of serious incidents during this time frame. Registry data was collected retrospectively from electronic records for both, 8 weeks pre-lockdown and the first 8 weeks of the lockdown. There were no significant changes within hospitals admissions for children and adolescents (pre: $n = 14$, in: $n = 17$) but a significant decrease in referrals to mental health services for children and adolescents from pre-lockdown to lockdown (pre: $n = 2193$, in: $n = 1081$, $p = .001$).

Kose et al. (2021) analyzed the effects of the COVID-19 pandemic on child and adolescent psychiatry emergency admissions in Turkey. Electronic patient records from a total of 427 patients presenting to the emergency department (ED) were retrospectively collected from the periods March 11th to June 11th, 2020 ($n = 66$), December 11th, 2019 - March 10th, 2020 ($n = 140$) and the same three-month periods in the previous year (March 11th - June 11th, 2019 ($n = 128$) and December 11th, 2018 - March 10th, 2019 ($n = 93$)). During the pandemic period, the total number of psychiatric admissions to the emergency department was significantly reduced compared to the same period in the previous year (March - June 2019) with an incidence risk ratio (IRR, 95% CI) of 1.94 (1.44 – 2.80, $p = .000$), and the preceding period of December 2019 - March 2020 with an IRR = 2.12 (1.47 – 3.05, $p = .000$) which is corresponding to a 48.45% respectively 52.83% reduction in admission rates. Separate subgroup analyses revealed the incident risk ratio to be IRR = 11.0 (1.30 – 93.05, $p = .028$) during March 2019 - June 2019; translating to a 90.90% reduction in the pandemic period admissions for suicidal ideation without suicide attempt compared to the previous year, and IRR = 14.0 (1.69 – 116.18, $p = .015$) during December 2019 - March 2020; a 92.85% reduction from the pre-pandemic period in the same year. A significant 70.58% reduction was observed in low-risk suicide attempts in the pandemic period compared to December 2018 - March 2019 IRR = 3.40 (1.39 – 8.31, $p = .07$); with an 82.14% and 75.00% reduction, both significant, in comparison to the pre-pandemic period in the same year IRR = 5.6 (2.39 – 13.13, $p = .000$) and the same period in the previous year IRR = 4.0 (1.66 – 9.62, $p = .002$), respectively. Furthermore, a significant increase in incidence rate ratio in March - June 2019 IRR = 3.50 (1.25 – 9.82, $p = .017$) and December 2019 - March 2020 IRR = 4.75 (1.75 – 12.93, $p = .002$) was detected for patients presenting with alcohol or substance intoxication compared to the pandemic period of March - June 2020; translating to a 71.42% reduction from the previous year and a 78.94% reduction from the preceding pre-pandemic period.

This study by the European Society for Child and Adolescent Psychiatry (ESCAP) Research Academy (Revet, Hebebrand, Anagnostopoulos, Kehoe, Klauser, et al., 2021) reports the results of the first of three surveys evaluating the impact of the COVID-19 pandemic on child and adolescents psychiatry services in Europe. From mid-April to mid-May 2020, 82 responses to an online self-report questionnaire from 20 countries were received and analyzed. In the majority of countries, schools had been closed “fully” or “partially” (combined $n = 79/81$; 98%) for a mean of almost 6 weeks ($M = 5.8$ weeks; standard deviation; $SD = 1.5$ weeks). A large majority of CAP services reported no COVID-19 positive cases among their inpatients ($n = 52/63$; 83%). Closures or reductions in the number of treated patients were experienced in outpatient units ($n = 50/56$; 89%), daycare facilities ($n = 38/56$; 68%), and inpatient units ($n = 18/56$; 32%) throughout Europe. Overall, the reduction was roughly two-thirds for outpatients (69.9 ± 135.3 in 2019 to 24.7 ± 35.2 during COVID-19) and one-third for inpatients (31.9 ± 22 versus 8.1 ± 16.6). About half of participants observed a medium impact on their patients' mental health: increased anxiety disorders (36%), conduct disorders (27%), adjustment disorders (24%), obsessive–compulsive disorders (24%), and suicidal crises (24%). However, 32% of them highlighted no change. Telemedicine was adopted by almost every team despite its sparse use prior to the crisis. Overall, these first results were rather homogeneous and showed a substantially reduced patient load and a moderate effect of the COVID-19 crisis on psychopathology for children and adolescents.

A retrospective cohort study from Ougrin et al. (2021) analyzed the self-harm behavior of children and adolescents during lockdown in 10 different countries. The analysis included a total of 2073 acute hospital presentations by 1795 <18-year-old children and adolescents. Data was compared from t_1 : March - April 2020 ($n = 834$) and t_2 : March - April 2019 ($n = 1239$). In 2020, there were significant more hospital visits due to self-harm than in 2019 ($p = .009$; OR = 1.33, 95% CI [1.07, 1.64]). Children and adolescents with a previous history of self-harm showed an increase in acute hospital presentations in 2020 (from 29 to 36%, and from 63 to 71%, respectively). Among patients with an additional disorder, the emotional disorders increased significant with an estimated odds ratio of 1.58, (95% CI [1.06, 2.36]; $p = .025$).

A report from Revet et al. (2021) presents the main findings from the second questionnaire of the CovCAP longitudinal survey. The target of the CovCAP survey was to analyze the impact of COVID-19 on child and adolescent psychiatry (CAP) services in Europe. The first questionnaire was conducted in March/April 2020. Data was collected between February 19th and March 25th, 2021 in

32 different countries. A total of 60 participants were recorded and answered the self-report online questionnaire survey. There was an increase in the perceived impact on the mental health and psychopathology of children and adolescents dramatically from “medium” (> 50%) in 2020 to “strong” or “extreme” (80%) in 2021. The number of referrals or requests for assessment also rose in 2021. Most impacted disorders were suicidal crises (83%), anxiety disorders (70%), eating disorders (64%) and major depressive episodes (61%). Regarding the interference of care provision, the analysis showed 59% reported only a minor impact (2020: 68% reported major impact). Heads of the CAP departments expressed strong concerns regarding the management of the long-term consequences of this crisis, especially regarding the provision of care in light of the perceived increase in referrals.

In an electronic health record study, Patel et al. (2021) examined the use of remote consultation on the prescribing of psychiatric medications during COVID-19. Data from all patients receiving care from South London and Maudsley (SLaM) NHS Foundation Trust (around 37'500 patients per week) between January 7th, 2019 to September 20th, 2020 was extracted. Participants between <18 years and > 65 were analyzed. Following the onset of the pandemic, the frequency of in-person contacts was significantly reduced compared with that in the previous year (β coefficient: -5829.6 contacts, 95% CI [-6919.5, -4739.6], $p < .001$), while the frequency of remote contacts significantly increased (β coefficient: 3338.5 contacts, 95% CI [3074.4, 3602.7], $p < .001$). Rates of remote consultation were lower in older adults than in working age adults, children and adolescents. Despite this change in the type of patient contact, antipsychotic and mood stabilizer prescribing remained at similar levels. The COVID-19 pandemic has been associated with a marked increase in remote consultation, particularly among younger patients. However, there was no evidence that this has led to changes in psychiatric prescribing.

Conlon et al. (2021) conducted a qualitative study to assess the impact of COVID-10 on child health and the provision of care in pediatric emergency departments (ED). Between August and October 2020, a total of fifteen semi-structured interviews were conducted with frontline staff (emergency medicine clinicians ($n = 5$), nursing managerial staff ($n = 6$), medical social workers ($n = 2$) and nursing staff ($n = 2$). These seven main themes were identified: 1) Declines, delays and avoidance: changing pediatric presentations. The attendances dropped and there were delayed presentations to the ED which led to prolonged treatment or worsened outcomes for children. There were less presentations of children with complex needs and chronic conditions suggesting that parents were more likely to stay at home cause of the infection risk. 2) Parental concerns: contagion and

messaging. Among parents, there were high levels of reluctance to attend the ED. 3) Psychosocial impact on children. The presentations of children relating to psychosocial issues increased. 4) Disrupted access to community healthcare. Accessing GP care became more difficult as there were little or no appointments available. 5) Re-configuring the ED to create capacity. The closure of (specialist) schools etc. was found to negatively impact children's mental health and wellbeing. 6) Quality and safety in care delivery processes. Significant and rapid operational changes in EDs were implemented in March 2020. This spatial and operational re-configuration of the ED was positively accepted by clinicians but there has been increased stress among staff and challenging situation for leaders. 7) Psychological challenges for staff. The anxiety of contracting and transmitting COVID-19 was a concern for ED staff.

Hansen et al. (2021) collected national Danish registry data from February 25th 2019 to May 3rd 2022 regarding all professional-patient contacts between psychotic patients and psychiatric hospitals, outpatients' clinics, and general hospitals in Denmark. The total number of contacts included in the analyses of diagnoses was 1'796'831 (contacts from patients without diagnosis were omitted). The dataset has 62 weeks of data with 933–1'597 weekly acute contacts and 6'140–32'759 weekly contacts for all attendances. For most patient groups, the total number of contacts did not decrease significantly as virtual contacts replaced most FTF contacts during the lockdown. However, for child and adolescent patients diagnosed with F 10–19, 70–79, and 80–89, the number of contacts decreased during lockdown. The number of weekly contacts decreased in patients treated for substance misuse (ICD-10 F10–F19; coefficient = -11.56, $p < .001$), patients with intellectual disability (ICD-10 F70–F79; coefficient = -92.99; $p < .001$), and patients with pervasive and specific developmental disorders (ICD-10 F80–F89; 201.38, $p = .005$). For all the other diagnosis groups no significant reduction was found in total weekly contacts.

Ching et al. (2021) assessed clinical psychologists'/assistant psychologists' perceptions of COVID-19's impact on patients and families as well of the experiences of providing support during these times. Data was collected in a pediatric hospital in the UK between August 14th and October 12th, 2020. Respondents described perceived impacts on patients and families around social isolation, school closure, family relationships, physical health, mental health, treatments and social support. Whereas positive impacts of the COVID-19 pandemic were rarely mentioned (between 4 and 9 percent), most of the participating psychologists indicated that they perceived a negative impact of the COVID-19 pandemic on all of the above mentioned aspects (between 20 percent (family life) and more than 70 percent (friendships)). Respondents' experiences of providing mental health

support during COVID-19 highlighted themes around providing remote/virtual support, workload and facilitators and barriers to their work. Respondents experienced challenges with engagement (including technical difficulties) in remote/virtual psychological work. They reported increased workloads due to both new referrals and current patients experiencing mental health difficulties as a result of COVID-19. As facilitator, psychologists mentioned peer support, including teamwork and transparent communication, that aided the support they provided for families and professionals.

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 29th, 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 8th to 28th). 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.

In the UK a controlled interrupted time series study by Chen, She et al. (2020) using data from Cambridgeshire and Peterborough NHS Foundation Trust (CPFT), UK (catchment population 0.86 million) found an instantaneous drop in mental health referrals but then a longer-term acceleration in the referral rate (by 1.21 referrals per day per day, 95% CI [0.41, 2.02]). This acceleration was primarily for urgent or emergency referrals (acceleration 0.96, 95% CI [0.39, 1.54]), including referrals to liaison psychiatry (0.68, 95% CI [0.35, 1.02]) and mental health crisis teams (0.61, 95% CI [0.20, 1.02]) in adults age 20 – 65-year-old but was not seen in children and adolescents nor elderly. Authors discuss a potential insufficient of these vulnerable age groups to access mental health services.

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).

A Dutch study (Sari et al., 2021) recruited parents during the period of school and day care closure (April 17th to May 10th, 2020) and matched the sample (COVID-19 sample, $n = 206$) to a sample of parents from the Generation R Study ($n = 1030$). The COVID-19 sample had a higher score on the total harsh parenting scale ($p < .01$) and had a higher prevalence of the following items: "called my child names" ($p < .001$) and "called my child stupid, lazy, or something like that" ($p < .001$). Effect sizes of the pre- and post- pandemic differences in item scores were medium to large. The study suggests that parental tolerance for children's disobedience was lower and abusive parenting responses were more difficult to inhibit under the adverse circumstances of COVID-19.

Children with a neurodevelopmental disorder and mental health impact

Nonweiler et al. (2020) conducted a cross-sectional parent-reported study from April 2nd to June 2nd, 2020 in the UK, using the Strengths and Difficulties Questionnaire (SDQ). 371 children and

young people (CYP) with neurodevelopmental disorders (NDDs) were compared to neurotypical controls and showed a higher prevalence of emotional symptoms (42% vs. 15%; $\chi^2 = 21.0$, $p < .001$) and conduct problems (28% vs. 9%; $\chi^2 = 13.2$, $p < .001$), and fewer prosocial behaviors (54% vs. 22%; $\chi^2 = 22.5$, $p < .001$).

Conte et al. (2020) launched an online survey via a local patient advocacy website to investigate mental health issues in children and adolescents with **Tourette syndrome** (TS). Respondents were parents, who were asked to report on their child's general health, tics, comorbidities, therapy, and daily routine. A significant worsening of the overall clinical picture occurred in two-thirds of the subjects (67.18%), while 20.51 experienced an improvement and 5.64% a variation with no clear trend toward improvement/worsening, only 6.67% reported no variation at all. Most worsened symptoms, as rated by parents in over 25% of subjects, included tics, hyperactivity, rage attacks, obsessions/compulsions and anxiety. No association was found between symptom variation and family demographics or health and economic issues that were specifically related to the lockdown.

A German study from Wieting et al. (2021) aimed to investigate the effect of COVID-19 on the mental health of people with **Prader-Willi syndrome** (PWS). A total of 108 caregivers (age: 24–79 years, $M_{age} = 50.7$ years) of 89 PWS patients over 6 years ($M_{age} = 21.3$ years) answered the online questionnaire between August 3rd and 25th, 2020. 28 PWS patients were living in family, and 25 were accommodated in a specialist care facility. 67.3% of the caregivers perceived restrictions in the provision of care and 82.4% a reduction in employment/daytime activity. They also reported a rise in psychopathological symptoms during the lockdown: temper outbursts (51.7%), conflicts with other people (46.1%), and irritability (55%), depressed mood (43.8%), anxiety (38.2%), social withdrawal (33.7%), daytime sleepiness (40.4%), desire to eat (39.3%), obsessive-compulsive behaviour (33%), psychotic experiences (24.4%), suicidal thoughts (5.6%). The majority of the patients (85.4%) were concerned about COVID-19. PWS patients who were accommodated felt a stronger increase in feeling anxious (56.0%) than PWS patients who were living in families (42.9%). On the other hand, accommodated PWS (36.0%) went through smaller increase in temper outbursts than the one in families (57.1%) as well as conflicts with other people (specialist care 40.0%; family 60.7%), concentration problems (specialist care 28.0%; family 39.3%), sleep problems (specialist care 12.5%; family 35.7%), compulsive behavior (specialist care 24.0%; family 42.9%) and skin-picking (specialist care 32.0%; family 57.1%). PWS patients in specialist care showed a significant lower increase in irritability (care facility 32.0% and family 78.6%; $X^2(1, N = 53) = 11.662$, $p < .001$)

and food seeking behaviour (specialist care 24.0% and family 57.1%; $\chi^2(1, N = 53) = 5.975, p = .016$) than those living in families.

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

In an Italian cross-sectional study, Melegari et. al. (2021) collected data between June 4th and June 21st, 2020 on the impact of the COVID-19 pandemic on the emotional mood and behavioral dimensions in children and adolescents with attention deficit hyperactivity disorder (ADHD). Parents of 992 children and adolescents with different ADHD severity degrees completed an online survey. The results show that the frequency of mood and behavioral problems significantly decreased in children and adolescents with low severity ADHD with the exception of little enjoyment/ interest in children and physical aggression in adolescents. Moderate severity ADHD groups showed an increased frequency in boredom, temper tantrums and little enjoyment/interest domains. An increased percentage of children of the moderate group showed increase in sadness and adolescents increase in physical aggression. In both groups, no significant differences were found in restlessness, opposition, verbal aggression, argument, irritability and anxiety dimensions. The group of high severity ADHD differed from both other groups. They showed “an increase in the percentage in almost all dimensions with the exception of restlessness and opposition” while in adolescents, they observed “an increased percentage only in boredom, temper tantrums, little enjoyment/interest and argument.” Regarding the severity degree of emotional and behavioral problems, the low severity ADHD group showed a very low stability degree. Children and adolescents with moderate to high severity ADHD showed a higher degree of stability in mood and behavioral dimensions. “Children and adolescents with previous severe degree, during the lockdown, showed a significant improvement in opposition, restlessness irritability and argument; however, they continued to report higher rates of worsening in little enjoyment/ interest and equivalent rates of worsening-improvements in boredom.” This study shows that restrictions as seen in the COVID-19 lockdown “could have presented a protective condition from common social stressors”.

In a case-control study from Italy, Tessarollo et al. (2021) examined in May 2020 how children between 6 and 15 years with ADHD coped with online distance learning (ODL) during COVID-19 pandemic and what implications this schooling method had on their emotional and behavioral well-being. 276 mothers of schoolchildren participated in the study: 92 mothers of children with ADHD, and 184 of typically developing children. For children without ADHD, they used data from a nationwide online survey of mothers of primary and middle school students which was conducted to

explore the experiences in organizing school for children at home and its implications on children's psychological well-being and educational progress during the quarantine. For children with ADHD, they created a semi-structured questionnaire. Regarding socio-demographic differences, mothers of ADHD students had a lower level of education and were more unemployed than mothers in the control group. Regarding the organization of the online distance learning, mothers of ADHD sons experienced more difficulties in reconciling the commitments as mother, worker, and home teacher than controls. Both before and after lockdown, more ADHD children were cared for by parents than control children, whose parents were more helped by grandparents and others (relatives and family friends). ODL was considered as disorganized by approximately 26% of both groups and between 73 and 83% rated its routine as instable. More than 81% of both groups judged the effort that was required by children as great. Dispensatory and compensatory measures were guaranteed more frequently to children with ADHD (59.8%) than for children in the control group with special educational needs (25.6%). Compared to controls, ADHD students were often not assessed by the teachers and 40.9% did not receive any grades. Most participating mothers felt they had to ensure greater participation (71.0%) and greater commitment (78.9%) to follow their children in ODL, enough to have replaced the teacher (79.8%). In both groups there was a deficiency in support teacher intervention for eligible children (ADHD group 63.3% vs. control group 54.4%), with support provided once a week in half of the overall sample. Teachers were not considered reachable for 31.3% of general population, by the control group. Attention span was more limited (almost 20 minutes) in children with ADHD than in controls and, consequently, there were breaks every 10 minutes. Similarly, spontaneous commitment and autonomy in ODL were significantly more compromised in ADHD patients than in controls. Among ADHD cases without reported restlessness problems (43.3%), more than half perceived an increment in captured attention compared to the control group. In the ADHD group, all available communication platforms were used quite frequently, while the use of some specific platforms prevailed in the control group, such as web-based platforms (66.9%) and videoconference tools (63%). YouTube and e-mails, however, were more often used by ADHD students than controls. Overall, the time spent on video by children with and without ADHD for the didactic activity was similar, while the recreational use prevailed in the ADHD group, who spent from 4 to 6 hours on video games (93.3 %) or tutorials (73.3%). Mothers of ADHD students reported more often that ODL did not provide their children with an adequate level of learning. Mothers of children without ADHD were more likely to refuse the ODL.

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).

Moulin et al. (2021) assessed correlates of children's emotional difficulties and symptoms of hyperactivity/inattention during the lockdown in France. A total of 432 parents filled-in the online questionnaire. Mean age of children was 6.8 years ($SD = 4.1$). Age- and sex-adjusted logistic regression analyses showed that the odds of children's high levels of emotional difficulties were elevated among those who had sleeping difficulties ($OR = 2.6$, 95% CI [1.2, 5.7]), whose screen time was more than 1 h per day ($OR = 6.8$, 95% CI [1.5, 30.9]), whose parents had symptoms of anxiety-depression during lockdown ($OR = 8.1$, 95% CI [2.4, 26.8]), or who had financial difficulties ($OR = 4.2$, 95% CI [1.6, 11.0]). Children's symptoms of hyperactivity/inattention were elevated among children who had sleeping difficulties ($OR = 2.0$, 95% CI [1.1, 3.3]), had parents with symptoms of anxiety or depression ($OR = 2.6$, 95% CI [1.1, 1.2]), financial difficulties ($OR = 2.3$, 95% CI [1.1, 4.6]), or who were unemployed ($OR = 1.8$, 95% CI [1.1, 3.3]). Children's emotional and behavioral difficulties are associated with parental mental health and socioeconomic difficulties.

A study by Raw et al. (2021) that is part of the longitudinal Co-SPACE study in the UK focused on mental health effects during the lockdown. Parents and caregivers from 4 to 16-year-olds filled in a questionnaire at baseline and at least one follow-up questionnaire. Growth curve analyses showed an increase between April and July 2020 in hyperactivity/inattention, while conduct problems and

emotional symptoms remained relatively stable. Although many children maintained stable low symptoms, other children showed elevated symptoms in July. Predictors of such elevated symptoms were parent/career with higher self-reported mental health symptoms (of depression, anxiety, and stress), having special education needs or neurodevelopmental disorders, and to be younger in age. Moreover, different types of symptom trajectories were identified.

An Italian study by Giannotti et al.'s (2021) focused on child externalizing behaviors. They conducted an online survey with 602 parents (87% mothers) during the home confinement in 2020 (20th April–18th May). They observed that child externalizing behaviors as measured by the Strength and Difficulties Questionnaire increased during the lockdown period. Thereby, child externalizing behaviors were predicted by male gender, less parental time dedicated to the child, higher parental stress, and child distance learning workload. Regarding parents, parental stress (especially in mothers) as measured by the Parental Stress Scale also increased during the lockdown period. A strong predictor of parental stress was coparenting, together with being a mother, younger child age, less time dedicated to the child, and scarce feasibility of remote working.

Autism Spectrum Disorder: Well-being and social contact

Siracusano et al. (2021) investigated the impact of lockdown due to COVID-19 pandemic on the adaptive functioning, problematic and repetitive behaviors of 85 Italian preschoolers and schoolers with Autism Spectrum Disorder. Within the Preschooler group, after the lockdown, a significant improvement emerged in almost all domains of the Adaptive Behavior Assessment System, (General Adaptive Composite, $p = .014$; Conceptual Adaptive Domain, $p = .031$; Practical Adaptive Domain, $p = .047$). Whereas, in the Schooler group, no significant result was found between baseline and T1, in all the adaptive domains investigated. Participants whose parents underwent an online parental support during lockdown had a significant improvement in the Practical Adaptive Domain ($p = .027$) in comparison to the individuals with ASD whose parents did not receive such support. These findings underline the importance of parent care in ASD treatment, pertaining to involvement in the intervention and time spent at home with children.

Sergi et al. (2021) investigated how the behavior of children's with ASD changed during the complete lockdown and during the three months after the resumption of activities. They considered a sample of 88 children who had been diagnosed with Autism Spectrum Disorder (ASD), aged between 18 and 30 months. They all took part in a "principles and procedures of Applied Behavior Analysis (ABA)"-based intervention funded by the Local Health Authority of the province of Caserta

in Italy. Results show that during the lockdown, children experienced significant improvements in communication ($p < 0.05$), socialization ($p < 0.05$), and personal autonomy ($p < 0.05$). During the three months after the ABA treatment, the acquired skills were maintained but no significant improvement was demonstrated. Parent training was significant in avoiding delays in the generalization of socially significant behaviors, following the drastic interruption of the treatment in this group of children through the lockdown.

Mutluer et al. (2020) conducted a cross-sectional study in Turkey to investigate how individuals with ASD responded to COVID-19 in terms of comprehension and adherence to implemented measures; changes in their behavioral problems; and how their caregivers' anxiety levels relate with these behavioral changes. 87 individuals with diagnosed ASD – age ranged from 3-29 years – were included according to DSM-5 criteria by child psychiatrists. When asked about the changes in their child during the pandemic period, 55% of the parents said that their child got more aggressive, 26% said their child's tics increased or new tics emerged, 29% said their child's communication skills deteriorated, and 44% and 33% of the parents reported reduced sleep and appetite changes, respectively. All subscales of Aberrant Behavior Checklist differed significantly between before and after the pandemic conditions, indicating a worsening of the ASD individuals' functioning ($p < .001$, $\eta^2 = 0.26$).

In a cross-sectional study in Italy, Bentenuto et al. (2021) examined if the perceived levels of parental stress, coparenting quality and child externalizing symptoms changed in response to the COVID-19 outbreak. A total of 194 parents (82 parents of children with neurodevelopmental disabilities (NDD) and 82 parents of typically developing children (TDC) participated. The participating children were between 3 and 17 years old. In the NDD group, 59 % of children ($n = 49$) had a diagnosis of Autism Spectrum Disorder (ASD) and 41 % of other neurodevelopmental disorders ($n = 33$). Measured topics in the survey were; general information, Parental Stress Scale (PSS), Coparenting Relationship Scale (CRS), Strengths and Difficulties Questionnaire (SDQ), specific information about children with NDD and also open question to describe the most significant aspect of their experience as a parent during COVID-19 outbreak. Parental stress during lockdown was greater than before the lockdown phase ($p < .001$). In addition, the parental stress was greater in the NDD group compared to the TD group ($p = .036$). Externalizing behaviors in children with NDD were greater during the lockdown than before the lockdown and greater in children with NDD compared to TD. In children with NDD, the decrease of therapeutic/rehabilitation activities is

associated with higher externalizing behavior. The level of parental stress is predicted by child externalizing behaviors.

A study from the UK (Morris et al., 2021) investigated the impact of the pandemic, the lockdown and subsequent return to school, on the social development and communication of autistic children from their parents' perspective. They examined whether associations exist between social-communicative behaviors and the variables affected by the lockdown or return to school period. Parents from 176 autistic children answered the questionnaire at T1 (after the lockdown when children returned to school) and 54 follow-up questionnaires were returned at T2 after the first half term. During the lockdown, only 10.2% of children regularly attended school, suggesting that the school routine was disrupted for a great majority of children in the sample. Self-regulation skills ($p < .05$) and cooperation skills ($p < .05$) were most affected over the course of the lockdown. Children whose parents felt supported by their schools were reported to show an improvement in their social communication skills (i.e. social-communicative skills got a little bit better, or got a lot better) over the course of the lockdown ($p = .007$) and children who continued to see friends and family outside of school and the household were perceived to also show a slight improvement in their overall social-communicative behaviors in comparison to those who did not ($p = .002$). Children's physical activity levels were perceived to increase during the return to school ($p < .0001$), which was associated with better social-communication outcomes ($p < .05$).

This study from Türkoğlu et al. (2021) examined the impact of COVID-19 home confinement on autism spectrum disorder (ASD) symptoms and irritability in children and adolescents with ASD. Parents of 46 ADS children between 4–17 years ($M = 7.89$ years) completed an online questionnaire (including the Autism Behavior Checklist and the Affective Reactivity Index) between June 3rd and June 17th, 2020. The parents answered questions regarding the time of home confinement and pre-pandemic conditions. The Affective Reactivity Index scores and all subscale scores from the Autism Behavior Checklist (sensory, relating, body and object use, language, social and self-help) were increased during the home confinement period compared to the pre-pandemic period ($p < .05$), indicating that the ASD symptoms and irritability in children and adolescents with ASD worsened during the COVID-19 outbreak and home confinement. Irritability and Autism Behavior Checklist scores correlated positively during the stay-at-home period ($p < .05$). The results of the social and self-help subscales of the Autism Behavior Checklist were predictive of the irritability scores (OR = 0.47, CI [0.148, 0.689]; $p = .003$).

A cross-sectional study from Spain by Lopez-Serrano et al. (2021) examined the impact of the lockdown on symptoms and behaviors of children and adolescents with pre-existing psychopathology between March 2019 to April 2020. Primary caregivers of children who were treated in the year before the lockdown were invited to fill-in an online questionnaire on any change in problem behavior (23 items) during the lockdown. 441 from 967 invited completed the questionnaire. Most of the outpatients remained stable. However, a smaller part reported an increase in symptoms (little or much more than before), e.g. of attentional problems (46.4%), fatigue (29.6%) and irritability (45.5%). The diagnostic groups most affected were Autism Spectrum Disorders and Conduct Disorders. Differences were found for age and gender. In general, greater decreases in infants (younger than 8 years) and prepubescents (8 to 12 years) compared to pubescents (12 to 15 years) and adolescents (15 to 18 years). Infants and prepubescents showed higher percentages of incremented oppositional defiant behaviors ($\chi^2= 24.4$; $p = .02$), a gradual loss of social contact with peers (greater in the younger children) ($\chi^2= 47.7$; $p < .001$), increased irritability ($\chi^2= 28.8$; $p = .004$), increased dependence on adults behaviors ($\chi^2= 31.2$; $p = .002$) and increased repetitive body movements ($\chi^2= 32.5$; $p = .001$). Moreover, higher percentages of increased death-related anxieties were observed in the infants ($\chi^2= 22.4$; $p = .03$). Finally, prepubescents showed increased use of electronic devices ($\chi^2= 31.1$; $p = .002$), increased regressive behaviors ($\chi^2= 27.7$; $p = .006$) and increased attention problems in comparison to the other age groups ($\chi^2= 26.4$; $p = .008$). Compared to boys, girls showed slight improvement in healthy eating habits ($\chi^2= 12.1$; $p = .02$), great improvement in self-harm behavior ($\chi^2= 15.8$; $p = .003$) and in regressive behaviors ($\chi^2= 10.6$; $p = .03$), a slight increase in body dissatisfaction ($\chi^2= 10.9$; $p = .03$), and a great improvement in inflexibility (compared to a large deterioration among boys) ($\chi^2= 9.8$; $p = .04$). Meanwhile, boys showed a larger decrease of social contact with ($\chi^2= 10.9$; $p = .03$). Finally, the study found an association between parental stress and increased symptoms in children ($r = .41$, $p < .001$).

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. (2020) 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, Ragazzoni, 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 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 13th, 2020 and May 9th, 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 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, $SD = 0.75$).

An online cross-sectional survey (Dondi et al., 2021) was offered to families living in Italy with children up to 18 years old. Among the 730 (11.8%) families complaining of an increase in their children's unusual repetitive movements after the outbreak, 514 (70.4%) reported new-onset, while 216 (29.6%) worsening of pre-existing symptoms. A logistic regression analysis revealed that the worsening of mood was associated both with an increase in pre-existing unusual repetitive movements ($OR = 2.77$, $p < .001$) and the occurrence of new ones ($OR = 1.56$, $p = .002$); the same applied to the occurrence of feelings of loneliness that could not be verbalized (worsening of unusual repetitive movements: $OR = 1.89$, $p = .006$; new ones: $OR = 1.49$, $p = .003$). Aggravation of the symptoms was greater in children with ASD ($OR = 7.24$, $p < .001$) and other disabilities ($OR = 5.85$, $p < .001$).

Children with psychiatric disorders

Theis et al. (2021) conducted a cross-sectional study to assess how COVID-19 affected physical activity and mental health of children and young adults with physical and/or intellectual disabilities (see subchapter on physical activity). Between June 17th and July 17th, 2020, parents or carers completed an electronic survey comprising the Strength and Difficulties Questionnaire and other COVID-19 surveys, such as "Coronavirus: Impact on young people with mental health needs", youngminds.org). Data of 125 children with a mean age of 12.3 years ($SD = 4.3$) was collected. Over 90% of parents reported a negative impact on mental health.

A cross-sectional cohort study in Italy (Mensi et al., 2021) investigated the COVID-19-related psychiatric impact on adolescence with psychiatric problems as well as without psychiatric problems (see sub-chapter on health utilization) between April and June 2020 when with wide-ranging restrictions were in place. Specifically, the study focused on (a) the prevalence rate and sociodemographic correlates of COVID-19-related post-traumatic stress disorder (PTSD) and

COVID-19-related acute stress disorder (ASD), and (b) level of personal stress and of perceived parental stress, and connection with mental health. 1'262 adolescents between 12 and 18 years ($M = 16.27$ years; $SD = 1.63$) filled in an online questionnaire. The sample included 118 adolescents with psychiatric problems (APP+) and 1'144 adolescents without psychiatric problems (APP-). Adolescents with psychiatric problems did not systematically differ from those without psychiatric problems. The majority of adolescents (79.52%) reported isolated COVID-19-related acute stress (29.48%) or posttraumatic stress (50.04%) symptoms. Factors like region of residence, personal or parental history of COVID-19 and living with or without parents was not related to the presence of COVID-19-related ASD and PTSD in adolescence. There was a significant relationship between the presence of COVID-19-related ASD and PTSD in adolescence and the alteration in the content of thought ($p = .03^*$), and to experience dissociative symptoms ($p = .02^*$). Adolescents with subthreshold COVID-19-related ASD and PTSD symptoms referred the highest levels of personal stress and adolescents with psychiatric/psychological conditions experienced higher stress (11.7% vs. 10.0%; $p \leq .001^{**}$).

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 16th to May 10th, 2020 (age 3–18, $N = 354$). 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).

A study from Denmark (Nissen et al., 2020) investigated the effects of the COVID-19 pandemic on children and adolescents aged 7–21 years with **obsessive compulsive disorder (OCD)**. Between April and May 2020, a self-report questionnaire was given to two groups of children and adolescents: a clinical group, ($n = 65$, $M_{age} = 14.9$ years, $SD = 2.66$ years, 36.9% males) consisting of participants newly diagnosed with OCD in a specialized clinic in the Central Denmark Region and a survey group ($n = 37$, ($M_{age} = 14.14$ years, $SD = 2.79$ years, 33.3% males) consisting of members of the Danish OCD Association who were diagnosed years ago and already completed their primary treatment. The self-reported change in severity of OCD symptoms was measured using questions based on the symptom severity questions of the Yale-Brown Obsessive-Compulsive Scale (Y-

BOCS). Both groups reported an increase in the severity of OCD symptoms during the COVID-19 crisis, 44.6% in the clinical group (mean worsening of 3.21, $SD = 1.78$) and 73% in the survey group (mean worsening of 4.19, $SD = 2.62$). An increase in anxiety was reported by 32.3% of the clinical group and by 54.1% of the survey group, while a worsening of depressive symptoms was reported by 33.8% of the clinical group and by 43.2% of the survey group. 15.4% of participants in the clinical group described that thoughts about COVID-19 became an integral part of their OCD. In the clinical group, the worsening of the symptoms was most pronounced in younger members, in those with early age of onset, and with a family history of ADHD.

Conti et al. (2020) conducted an observational longitudinal study at the Fondazione Stella Maris (FSM) in Italy to investigate lockdown-related emotional and behavioural changes in the pediatric neuropsychiatric population. 141 families with children aged 1.5-18 years filled in two online questionnaires. For the population aged 1.5-5 years, anxiety and somatic problems increased as indicated by differences from pre-lockdown to lockdown in the Syndrome Scale Score in the Somatic Complaints ($p < .10$) and in the DSM-Oriented Anxiety Scale ($p < .05$). Younger age in the 1.5–5 years subpopulation resulted as “protective” factor. For the subgroup aged 6-18 years, obsessive-compulsive, post-traumatic and thought problems increased as indicated by the Child Behavior Check List questionnaire that showed differences in the Syndrome-Scale-Score-Thought-problems ($p < .05$) as well as in the Obsessive scale ($p < .05$) and the post-traumatic stress disorder scale ($p < .10$). Increases in psychiatric symptoms were associated with financial hardship experienced by the families during lockdown.

De Nardi et al. (2021) examined in their study how the Italian COVID-19 lockdown (March 9th to May 4th, 2020) affected Italian adolescents (13-18 years) with and without a somatic symptom disorder (SSD). The data for this cross-sectional observational study was collected between April 27th and May 3rd, 2020 by the Institute for Maternal and Child Health of Trieste, Italy. The anonymous semi-structured online questionnaire has been completed by 58 adolescents (52% female) who had being diagnosed with SSD at the Institute in the last year and 57 controls (46% female) which were healthy adolescents matched for age and sex who did not have SSD but had accessed the Institute for an injury or organic disease during the same period. The mean ages were 15.3 years for the SSD group and 15.8 years for the controls. The questionnaire comprised the Multidimensional Anxiety Scale for Children Self Report (MASC-2-SR) and the Children's Depression Inventory Short Form (CDI-2-SF) which they had to answer regarding the last previous eight weeks in lockdown. The results showed that the SSD group had lower anxiety raw scores than the controls (50.8 and

58.6, $p = .05$) but did not differ in terms of their anxiety T-scores (0.9 vs. 1.3, $p = .45$). However, there has been found some significantly lower scores for the SSD group compared to the controls on the MASC-2-SR subdomains including the physical symptoms, social anxiety and tension and restlessness ($p < .05$). Furthermore, the CDI 2-SF raw scores 49 and 55.6 ($p < .05$) and the mean CDI 2-SF T-scores 4.7 and 7.2 ($p < .05$) showed that adolescents in the SSD group experienced significantly lower levels of depression than the controls. This study shows that the SSD group experienced less depressive and anxiety tendencies than the healthy controls during the eight-week COVID-19 lockdown period. The SSD group also reported significantly less physical symptoms than the control group. A potential cause is the reduction of external stressors such as social pressure due to the lockdown.

A survey-based cross-sectional study from Italy (Guido et al., 2021) investigated the impact of the lockdown on the clinical course of children with the Pediatric Acute-Onset Neuropsychiatric Syndrome (PANDAS/PANS). Parents of 108 children, adolescents and young adults (aged 3-21 years, 23% female) completed a web-based proxy report survey. Symptoms increased during the lockdown in 71% of the sample. Symptoms were neurology disturbances such as tics, cognitive difficulties, affective and thought problems and behavioral problems such as somatic complaints, excessive use of video games, opposition, hyperactivity, or aggressive/destructive behavior or compulsions. The increase in symptoms is best explained by the presence of sleep disturbances and emotional lability. Increased symptoms during lockdown were correlated with mood problems characterized by irritability ($p < .01$), sadness/depression ($p = .012$), somatic complaints ($p = .18$), anxiety ($p = .37$), and crying ($p = .042$). There is also an increase in oppositional behaviors ($p = .006$) and sleep problems ($p = .004$). An onset of new symptoms emerged in children and adolescents with depressed mood ($p < .001$) and eating problems ($p = .022$) and in general, with the group reporting an increase in symptoms during lockdown ($p = .026$). Among the strategies implemented by parents to manage their children's stress during the time of social isolation were the use of relational activities (87%) such as joint activities, reassurance, dialogue and active listening, and distraction oriented strategies (68%) such as the use of technological tools, and chores around the house when children were most stressed.

A study from Favreau et al. (2021) evaluates the impact of the pandemic on patients with various psychiatric disorders who were admitted to inpatient treatment. 538 (70.3% females, $M_{age} = 35.3$ years, range 12-28 years) inpatients with mental disorders participated in a survey about psychological consequences of the pandemic between March-December 2020. In all age groups,

more than 50% reported any worsening of symptoms, 40% stated increased need of therapeutic support. High rates of symptom deterioration were observed for depressive symptoms (>55%), anxiety (>40%), and sleeping behavior (>40%). Treatment impairment was stated by 27.9%. Differences between adults and adolescents were found with only small effect sizes for: restricted visiting of older or chronically ill persons, financial worries, worries associated with potential COVID-19 infections, and helpfulness of positive thinking with higher values for adults ($p < .05$). Adolescents showed higher values symptoms of suicidality/self-harm worsened compared to adults ($p = .029$). All other comparison results did not differ (all p 's $> .05$).

Children with chronic diseases and mental health impact

Zorcec et al. (2020) investigate the needs and challenges of families with children with chronic respiratory diseases (i.e., Cystic Fibrosis (CF), Asthma, Tuberculosis (TB) and Rhinitis Allergica) in Macedonia. Data was collected between May and July 2020. In a questionnaire that comprised 118 questions, they assessed general information about the family, general information about the child, as well as overall physical and mental health before and during the pandemic. 72 parents/caregivers filled in the questionnaire. They observed significant decreases in children's mental health from very well to well ($p = .0006$) as well as in children's physical activity from more than 2 hours per day to few hours per week ($p = .0006$).

A cross-sectional study from Ademhan Tural et al. (2020) was conducted in Turkey in April 2020. Parents of 4-18-year-old-children and adolescents with chronic lung disease ($n = 113$) as well as a control group of parents with children without chronic lung diseases ($n = 108$) filled in questions on children's general health (General Health Questionnaire-12), on specific COVID-19 related anxiety (Coronavirus-related psychiatric symptom scale), and on their coping strategies (Coping Orientation to Problems Experienced inventory). Parents of children with chronic lung disease were more concerned about a transmission than parents of children without chronic lung disease ($p < .05$). Also, parents reported higher anxiety symptoms in children with chronic lung diseases than those of children without chronic lung disease ($p = .007$). Regarding parents' coping style, parents of children with chronic lung disease reported to use more problem-focused coping strategies than parents from the control group.

In a prospective study, Riccio et al. (2020) recruited 27 primary ciliary dyskinesia (PCD) patients and 27 healthy controls in Italy. To assess psychological well-being during COVID-19 lockdown, the psychological general well-being index and parenting stress index-short questionnaires were

administered to participants that were 15 years or older and to mothers of participants that were younger than 15 years. Data was then compared to data of the same period in 2019. Although PCD mothers tended to show higher parental stress levels or distress levels than mothers of healthy control, these differences were not statistically significant. In fact, the PCD pulmonary exacerbations occurred less frequently, and weekly chest physiotherapy sessions significantly increased in 2020 compared to the same period during 2019 ($p < .05$). Thereby, lower infectious exposure or improved compliance to chest physiotherapy were assumed to contribute to psychological well-being.

A cross-sectional study from Reinsch et al. (2021) examined the fears and behaviors of pediatric patients with Inflammatory Bowel Disease (IBD) during the COVID-19 pandemic in Germany. 46 children between 7 and 19 years and 44 parents participated. Data was collected with a survey between May 28th and July 1st, 2020. The survey was modified for pediatric patients from a previously published adult IBD cohort. Most patients and parents felt well informed about the coronavirus pandemic. The parents also felt sufficiently informed about the influence of COVID-19 on IBD, and 54% agreed to the statement "I feel sufficiently informed about the consequences of coronavirus on my child with IBD." The fear of being infected with COVID-19 was significantly higher in the patient group than in the parent group. However, the parents had high fear of their children being infected. This fear was significantly higher than the fear for oneself among both children and parents. Parents reported the highest fear toward the school environment as a source of infection, this fear was significantly higher than the fear of the pediatric IBD patients ($p = .016$). In general, the fear of being infected at health care facilities (hospital and private practice) and at public places such as supermarkets was low in both groups. None of the surveyed pediatric patients reported stopping any IBD medication on their own account. A total of 28.9% of the children and 25.6% of the parents reported wearing PPE, such as surgical face masks, in places that did not mandate such equipment. Personal hand hygiene was enhanced in both groups (84% of patients and 95.3% of parents). Patients with IBD reported leaving the house less frequently than they did before the COVID-19 pandemic, and 40% of pediatric patients with IBD reported leaving the house less frequently than other household members, as opposed to only 18% of surveyed parents ($p = .001$). Neither parents nor patients with IBD preferred medical video consultations to in-person consultations.

A cross-sectional Turkish study from Dilek et. al. (2021) investigated the impact of COVID-19 on anxiety levels of children aged 8–18 years and also the impact on anxiety and depression levels of their parents. Thirty children with multiple sclerosis (MS) and their parents were recruited for the

study group and healthy 49 children and their parents were recruited for the control group. A web-based survey composed of State-Trait Anxiety Inventory (STAI; S-anxiety (STAI-S) and T-anxiety (STAI-T)) and Hospital Anxiety and Depression Scale (HAD; HAD-anxiety (HAD-A) and HAD-depression (HAD-D)) was completed by the children and their parents between March 11th and June 1st, 2020. The state and trait anxiety scores of MS patients and the HAD-anxiety and depression scores of their parents were positively correlated. In the healthy group, there was no significant correlation between the STAI-S and STAI-T scores of controls and HAD-A anxiety scores of their parents ($p = .285$, $p = .489$, respectively). There was also no correlation between STAI-T and STAI-S scores of healthy children and HAD-D depression scores of their parents ($p = .247$, $p = .115$, respectively). More data was collected on everyday changes due to the lockdown: Only 63.3% of patients reported that they cared for their recommended diet, 43.3% of patients put on weight despite that 46.1% cared for their diet. Those who put on weight had significantly higher STAI anxiety scores compared to the patients who did not gain weight. 70% of the patients disrupted their regular health checks. STAI scores were not significantly different between patients who could and who could not have regular health checks. 86.7% of the patients reported that they took their medications regularly. 80% of the patients thought that during the pandemic they had a higher risk and more severe symptoms compared to healthy individuals. 36.7% reported that they thought that their medication would increase the risk of COVID-19 infection, but their anxiety levels did not differ from the other patients. 10% of the patients had a multiple sclerosis attack during the period.

A Turkish cross-sectional study by Cenk et. al. (2020) examined the anxiety levels of children with cystic fibrosis (CF) disease compared to those of healthy children between April 30th and May 15th, 2020. 132 CF children and 135 healthy children aged 7-18 years were asked questions via telephone in supervision of their parents. CF patients were feeling less anxious about the COVID-19 pandemic compared to controls ($p = .01$), less anxious of the risk that family members become infected with COVID-19 ($p < .001$), less upset about the school closure ($p < .02$), and less anxious about the COVID-19 pandemic ($p < .01$). As potential reasons for this unexpected result, children were home schooled during the data collection so that CF patients knew that there are just a few cases of CF patients with COVID-19 infection and that the infection has a mild course, which led to a relieve in CF children. Also, CF children were less upset about school closure than healthy children, which may explain why CF children showed less psychosocial maladjustment and have longer stays at home. However, despite these results that point to the resilience of CF children, almost 50% of the children of both groups were reporting appetite changes and 10-15% of children of both groups were experiencing sleeping problems.

Filardi et al. (2021) investigated the effect of COVID-19 on children and adolescents suffering from narcolepsy who are treated with sodium oxybate. They performed a routine follow-up actigraphy with 30 children between 10 and 16 years ($M_{\text{age}} = 13.27$; $SD = 3.47$). The data was collected between November 2019 and January 30th, 2020. Data contained actigraphic parameters, ESS-CHAD (Epworth Sleepiness Scale for children and adolescents) score and BMI. During the lockdown period on weekdays as well as on the weekend, children went to bed later ($p < .0001$; Hedges' $g = 1.89$), woke up later ($p < .0001$; Hedges' $g = 1.70$), and had a later midpoint of sleep ($p < .0001$; Hedges' $g = 2.24$). Additionally, the participants slept more during the daytime, napped more frequently, and reported decreased physical activity levels during daytime (DMA; mean activity counts during daytime; $p < .0001$; Hedges' $g = -1.08$), increased estimated diurnal total sleep time ($p < .05$, Hedges' $g = 0.55$), higher naps frequency ($p < .01$; Hedges' $g = 0.67$), and an increase in naps on weekdays ($p < .0005$; Hedges' $g = -1.04$). Regarding the motor activity, participants showed significantly higher motor activity from 22:30 hours to 01:45 hours, and lower motor activity levels from 06:30 hours to 09:45 hours during the lockdown.

A cross-sectional study by Tezol and Unal (2021) explored COVID-19-related experiences in **children with sickle cell disease** (SCD). A total of 47 children between 14 and 24 years (mean age = 18.2 years) completed the instrument and the State-Trait Anxiety Inventory online. Sixteen patients (34%) reported a state anxiety score above 39 (cut-off point of 39–40), indicating significant clinical symptoms. Thereby, "the number of negative COVID-19 experiences was correlated with the state anxiety score, the trait anxiety score, and the number of painful episodes ($r = .552$, $p < .001$; $r = .529$, $p < .001$; $r = .448$, $p = .002$, respectively)".

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 ($Z = -4.838^{***}$).

Another study from Turkey (Onal et al., 2021) looked at the change in quality of life (QOL) and occupational performance in children with cancer during the Covid-19 pandemic. For the quantitative part of the study two assessments were carried out on 60 children ($M_{\text{age}} = 8.9$ years; $SD = 1.5$ years) and their families. The first in April of 2020, the second in September 2020. The pediatric quality of life inventory parent proxy-report was used to evaluate the QOL, and the Canadian occupational performance measurement was used to evaluate children's occupational performance (OP) and satisfaction. The results show a significant decrease on QOL during the pandemic: OQL-parameters such as cognitive state, perceived physical appearance and communication skills decreased significantly by 13.7, 7.1, and 22.1 points respectively, $p < .05$. Procedural anxiety and treatment anxiety of children during treatment increased. Furthermore, both the occupational performance and satisfaction of the children decreased significantly in the 6-month period, $p < .01$. The occupational performance score decreased from 5.5 ($SD = 1.1$) points pre-pandemic to 3.9 ($SD = 1.3$) points. The satisfaction score dropped from 4.8* ($SD = 1.2$) to 2.2 ($SD = 1.3$) points. No statistical change in the pain-related conditions of the children within 6 months of the pandemic was found, $p > .05$.

[* Numbers (M and SD) for satisfaction before COVID-19 are not consistent in text and table. In the text, the mean (standard deviation) for satisfaction before COVID-19 is $M = 4.8$ ($SD = 1.2$) and in table it is $M = 3.8$ ($SD = 1.3$).]

Van Gorp et al. (2020) studied the psychosocial impact of the start of the COVID-19 pandemic on Dutch children with cancer in outpatient care (pre-COVID-19/COVID-19 period: $n = 494/438$) and their caregivers ($n = 799$). Data was collected through health-related quality of life (HRQoL), pediatric quality of life inventory (PedsQL) generic and multidimensional fatigue scales between January and June 2020. Results show psychosocial functioning of children with cancer did not deteriorate because of the additional stress of COVID-19. The only observed difference was a decrease in the level of distress in the caregivers ($OR = 0.59$, 95% CI [0.42, 0.83], $p = .002$).

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 6th, 2020 and July 10th, 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 ($M_{age} = 10.67$; $SD_{age} = 2.29$). They investigated asthma control (see section on physical health) and children's and mothers' psychological functioning after the lockdown from May 28th, 2020 to August 23th, 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

A study by Sideropoulos et al. (2021) examined anxiety and worries during the first UK national lockdown in March 2020. In an online survey, 402 parents reported on the anxiety, worries and wellbeing of their son/daughter with Special Education Needs and Disabilities (SEND; e.g., autism, down syndrome, Williams syndrome, ADHD) and – if applicable – that of a typically developing (TD) sibling of the child with SEND ($n = 186$) at three time points. Anxiety tended to be higher across all three time points for those with SEND compared to the TD children. Moreover, COVID-19 impacted the worries of those with children with SEND more than that of their TD siblings. Also, school closures had a particular negative effect on children with SEND as, for example, schools and activity provide important routines and structures, which help to reduce anxiety.

A cross-sectional study from Spain (Berasategi Sancho, Idoiaga Mondragon, Dosil Santamaria, & Picaza Gorrotxategi, 2021) analyzed the well-being of children with special needs at the age 2–12 during the total lockdown in Spain. 1225 parents of which 3.1% ($n = 38$) had children with special needs completed the "well-being of children in lockdown" (WCL) scale between March 14th, 2020 and April 22nd, 2020. Compared to children without special needs, those with special needs scored lower on emotions ($p = .029$, Cohen's $d = .36$), on playful and creative activities ($p = .04$, Cohen's $d = .39$), on the physical activity dimension ($p = .04$, Cohen's $d = .32$) and in terms of their overall well-being ($p = .34$, Cohen's $d = .34$), although all effect sizes were small. Moreover, the children with special needs were found to be crying more, feeling more nervous than usual, getting more angry and feeling sadder. They also have more unhealthy habits, eat more than usual, overuse new technology and watch too much TV.

A longitudinal study from the United Kingdom (Bailey et al., 2021) examined the impact of the lockdown and ongoing social restrictions on families of 5 to 16 year-old-children ($M = 11.53$, $SD = 2.56$) with intellectual disability (ID). They used data from an ongoing UK study of families of children with ID. wave 1 was 2.5 years prior to data collection for wave 2 (April 9th to July 2nd, 2020). Data were available from 397 primary parental caregivers of children with ID at wave 2 of the study. Parental caregivers who completed their wave 2 surveys pre-lockdown vs. during/immediately post-

lockdown did not differ in their change from wave 1 to 2 in psychological distress ($p = .32$), life satisfaction ($p = .63$), caregiving impact ($p = .49$), or positive gains ($p = .95$). Also, the results did not differ in externalizing ($p = .27$), or internalizing ($p = .87$) behavior of the child with ID; nor for sibling externalizing ($p = .86$) problems. The study did thus not find any impact of the lockdown as measured by differences in the amount of change between wave 1 and 2 in parental well-being and child/sibling behavior and emotional problems between families who filled in the wave 2 survey either before or during the COVID-19 restrictions.

In a qualitative study from Scotland, Couper-Kenney and Riddell (2021) examined the extent to which the rights of children with additional support needs and disabilities (ASND) have been prioritized during the COVID-19. Between June and July 2020, they assessed 16 families including a total of 24 of children between 4 and 18 years old with ASND. Data collection took place via email (14) or online (2). The following three topics were central: Education, career and planning. Parents reported difficulties with internet access, navigating the new online systems and the stress to meet the children's individual learning needs. Families reported different experiences regarding the support from the school. Some were disappointed, wished for more appropriate work and active contacting. Other parents reported a higher degree of responsive communication from the school. They especially appreciated weekly calls from the teachers. They also reported mixed feelings about the general impact of the lockdown on education. Some of them, especially parents of older children feared the missing learning and exams. Others saw a positive chance in home schooling. Due to COVID-19 and the avoidance of all outside contact, parents and siblings had to take care of the child, since the personal assistants couldn't go to their home anymore. Parents reported that this was especially challenging for siblings. They had to carry out more physical and emotional care. Regarding the impact on children's mental health, parents reported both, negative and positive effects. Most of the families reported poorer mental health due to missing peers, missing other activities, and confusion about the situation. Eating was negatively affected, and parents were worried, that their child didn't do enough physical exercises, too. Some of the children were happier and more eager to study (less school-generated stress).

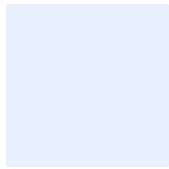
A part of a longitudinal study from Italy, Benassi et al. (2021) examined the physical, emotional and school dimensions of quality of life (QoL) during the period of COVID-19 lockdown in May and June 2020 in 120 primary school children from third-grade to fifth-grade with specific learning disabilities (SpLD, $n = 35$) and typically developing primary school children ($n = 85$). The online survey used the Paediatric Quality of Life Inventory (PedsQL) to measure the core dimensions of the QoL of

children, the school dimension to assess children's school well-being (QBS), and the Connor–Davidson Resilience Scale (CD-RISC 25) to quantify resilience in both the general population and in clinical samples. According to parents' reports, the physical functioning score ($p = .008$), the 'evaluation of learning processes' ($p < .001$), and the 'child's emotional difficulties at school' scores were lower for children with specific learning disabilities than those of TD children, indicating that children with specific learning disabilities experienced more problems. For the children with SpLD, maternal resilience was positively correlated with child's emotional functioning score and the 'child's awareness of their school performance' QBS scores, with the strength of these associations being medium or high, respectively. For the TD children, the maternal resilience was positively correlated with child's physical functioning score, the 'child's awareness of their school performance' and 'relationships with teachers' QBS scores, but the strength of these associations was weak.

A cross-sectional Italian study from Faccioli et al. (2021) investigated how Italian adolescents with disabilities and parents dealt with the COVID 19 lockdown. An online survey was completed between April 15th and May 15th 2020 by 53 adolescents ($M_{age} = 13$) and 239 parents. The majority of adolescents declared multiple disabilities, mostly motor difficulties (83%). The results show differences between adolescents and parents: "While 53.6% of the parents reported no positive effects of the lockdown, 92.5% of the adolescents expressed favorable consequences. The increased time spent with family members was judged positively by 27.2% of parents and by 64.2% of adolescents. Concern for their child's disability was expressed by 47.3% of parents, while 73.6% of adolescents expressed concerns regarding the ban on meeting friends. In both groups, anxiety symptoms were correlated with the fear of contracting COVID-19 and with financial problems."

In a study from UK (Asbury et al., 2021), 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., 2021).

LGBTQ+



Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults - 05.11.2021 - Julia Dratva, Frank Wieber, Simona Marti, Anthony Klein Swormink.



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).



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. Although parents from several countries perceived some chances (e.g., in terms of digitalization, structure, socio-emotional opportunities, inclusive education, and more time), they reported more challenges that they face (e.g., organizational difficulties, inequality, social distancing, pedagogical difficulties, number of tasks) to organize homeschooling and motivate their children. Particularly parents with children with mental health problems felt the school's support to be insufficient. Children with learning disabilities did experience difficulties during distance learning classes and were more likely to be sad, nervous, or troubled. Similarly, also children with additional support needs and disabilities showed poorer mental health due to missing their peers, missing other activities, and confusion about the situation, although some were happier and more eager to study and experienced less school-generated stress.

Preschoolers' overall basic school skills decreased between the pre- and post-pandemic period, with reduced language and math skills and increasing fears (e.g., fear of not being able to learn to read and write, the fear of punishment for failure, the fear of teachers in general, the fear of disciplinary action, the fear of poor school performance and the fear of not being able to make (enough) new friends). School closures decreased productive activities such as school, homework and extracurricular activities in preschoolers as well as children in primary school and increased non-productive times, including TV, passive screen time, social networks, and others.

In primary schools, about one third of children were only able to keep up their attention for a limited time (e.g., 20 min) and one-fifth needed frequent breaks (e.g., every 10 minutes). Also, problems such as reduced quality of learning, restlessness, and aggressiveness increased. Children aged up to 10 years reported missing their friends and playing with other children as well as the routine and structure of the early childhood education and care (ECEC) and school settings. Results from a natural experiment in Switzerland indicated that primary school pupils' learning in the subjects Mathematics, German, French and English slowed down and the interindividual variance in learning gains increased.

For older children, restlessness, anxiety, and sadness that was caused by loneliness were issues that accompanied distance learning for older students. Regarding learning time, a Swiss study showed that 14-25-year-old students studied on average 12 hours per week or 30 percent less during the school closure. Younger students and students from socioeconomically disadvantaged families showed a larger reduction in absolute studying time than older students and students from socioeconomically advantaged families. Students in Italian-speaking regions reduced their studying time less (7.54 h/week less) than students in German-speaking regions (11.53 h/week less) and French-speaking regions (14.81 h/week less). Results from a natural experiment in Switzerland indicated that secondary school pupils' learning was largely unaffected by school closures in their learning gains in the subjects Mathematics, German, French and English. Similarly, a study on German students observed no reduction in Mathematics performances before and during the school closure and observed that low-achieving students showed greater improvements in performance than high-achieving students.

One study from Portugal provides insights into the back to school period after the lockdown. The findings suggest that the "new school reality" affected adolescents' and young adults' mental and physical health as well as their social life. The confinement effects in the back to school period and the new school reality were perceived in a pessimistic way by nearly half of the adolescents and young adults, particularly by females and university students. More than half of the participants perceived negative effects of the new school reality on school performance.

However, given that this summary is still based on only on a limited number of studies, the results should be interpreted with caution.

Number of publications: 17

Results

A Swiss longitudinal study from Grätz et. al. (2021) investigated how large the loss of studying time was for students aged between 14 and 25 years during the closure of Swiss schools from March to June 2020 due to the COVID-19 pandemic. Data from 261 students was collected before school closure (September 2nd, 2019 to March 3rd, 2020) and during school closure (May 12th to June 30th, 2020). The results show that on average students studied $35.37 - 23.04 = 12.33$ h per week less during the closure of schools. This is a reduction of about 30 percent. Strong differences by age

were found. Younger students reduced their studying time significantly more than older ones (by $35.86 - 20.15 = 15.71$ h per week for younger students and $35.03 - 25.08 = 9.95$ h per week respectively for older students). There were no gender differences. Students from socioeconomically advantaged families showed a larger reduction in absolute studying time than students from socioeconomically disadvantaged families (low-educated parents: $28.45 - 18.79 = 9.66$ h/week less; medium-educated parents: $32.57 - 21.57 = 11.00$ h/week less; highly educated parents $41.40 - 26.64 = 14.76$ h/week less). There were also differences between the three linguistic regions in Switzerland such that the Italian-speaking students reduced their studying time less ($33.44 - 25.90 = 7.54$ h/week less) than the German-speaking students ($34.57 - 23.04 = 11.53$ h/week less) and the French-speaking students ($37.29 - 22.48 = 14.81$ h/week less).

In a natural experiment, Tomasik, Hebling and Moser (2021) compared the learning gains in the 8 weeks of school closures in Switzerland with the learning gains in the 8 weeks before the school closures with regular in-person school attendance. Data from all active users of the MINDSTEPS system (a computer-based formative feedback system developed at the Institute for Educational Evaluation in Zurich) who completed at least one teacher-generated assessment between January 19th and May 11th, 2020 were included in the statistical analyses. A total of 28'685 pupils participated from primary school ($n=13'134$) and secondary school ($n=15'551$). Comparing the slope of the learning progress before and after the school closures in the subjects Mathematics, German, French and English, primary school pupils in-person learning slope was more than twice as high as during school closures ($p < .001$), while in secondary school pupils the difference in the two learning slopes was not significant ($p = .31$). The variance of the two learning slopes differed in the primary school pupils ($p < .001$) but not in the secondary school pupils ($p = .32$). These results indicate that primary school pupils' learning slowed down and the interindividual variance in learning gains increased, while pupils from the secondary school were largely unaffected by school closures in their learning gains.

Esposito et al. (2020) conducted a cross-sectional study in Italy analyzing the psychological impact and changes in lifestyle due to school closures during the COVID-19 lockdown. 2064 adolescent students aged 11–19 years (62.8% females; M_{age} , 15.4, $SD = 2.1$ years) completed an online survey between April 8th and April 21st, 2020. School closure was associated with the development of psychological problems: The feeling of sadness was significantly more frequent in female than male participants (84% vs. 68.2%; $p < .001$) and in the older than the younger age group (79.2% vs. 70.2%; $p < .001$). The primary cause for sadness in all groups was loneliness. Another cause of

sadness was missing the school community, which was significantly more common in female participants (26.5% vs. 16.8%; $p < .001$), in southern Italy (26.45% vs. 20.2%; $p < .01$) and in the age group of the 14–19-year-olds (24.2% vs. 14.7%; $p < .001$). 68.4% of the participants reported that their relationship with their parents remained the same while 24.5% of the females declared that their relationships had improved compared to 19% of the males ($p < .01$). Male gender was a protective factor against negative feelings ($p < .01$), whereas having a family member or an acquaintance with COVID-19 increased the negative feelings ($p < .05$).

Pozas et al. (2021) explored primary school students' and parents' educational chances and challenges during homeschooling in Germany and Mexico. Following a qualitative approach, thirteen semi-structured interviews were conducted with parents and school students. Results from a qualitative content analysis revealed that parents across both countries face challenges to organize homeschooling and motivate their children. The Mexican sample attributed more chances ($n = 58$) than challenges ($n = 49$) to homeschooling, whereas the German sample expressed more challenges ($n = 98$) than chances ($n = 25$). Mexican parents experienced more challenges ($n = 31$ codes), while Mexican students reported more chances ($n = 41$ codes). In contrast, German parents ($n = 78$ codes) and students ($n = 20$ codes) experienced far more challenges. Chances comprised the categories digitalization, structure, socio-emotional opportunities, inclusive education, and more time. Challenges comprised the categories organizational difficulties, inequality, social distancing, pedagogical difficulties, number of tasks.

In a cross-sectional Spanish study, Bonal and González (2020) investigated the impact of the school lockdown during the COVID-19 pandemic on the learning gap between lower income with higher income families. 35419 families with children aged 3-18 years completed the online survey between March 26th and 30th, 2020. The results show that the pandemic increases already existing education inequalities and that the pandemic produces unequal learning opportunities. The study composed an index of opportunities to learn (OTL) for children aged between 10-18 years. An index of 0 means less than one hour per day is indicated for learning and index of 100 means more than four hours. 80.2% of the students had an index lower than 60. "Having greater access to digital devices, being enrolled in more advanced courses (older students had a higher OTL), being native to Spain or living in a higher-income household were all factors associated with higher OTL scores." Private schools had a significantly higher OTL than public schools. Also the survey reveals that "families with less cultural capital made more use of external resources to support their children's learning activities, while families with more cultural capital were more confident in their own abilities

to respond to their children’s learning needs.” Regarding after school activities, more children from parents with compulsory education had interruptions (80%) compared to children from parents with university degree (62%). This study shows that the pandemic and such lockdown and school closures makes “significant inequalities in exposure to school learning depending on family characteristics”. Also the results show that “families with a lower level of parental education attainment have fewer resources and less knowledge to help their children with school tasks.” Overall the study shows that school lockdown has not affected all children the same way.

Regarding the organizational changes due to home office and school closures for Italian families, Mangiavacchi, Piccoli and Pieroni (2021) examined “how the lockdown affected children’s use of time, their emotional status and their home learning, and whether the reallocation of intrahousehold responsibilities during the lockdown played a role in this process.” They developed a web survey and collected data of 3352 Italian families with children under 16 years during April 7th to May 3rd, 2020. The results show that there has been a significant change in the division of household tasks during lockdown and a “consequent increase in the time available for housework and childcare”. Regarding the daily activities of the children, the collected data shows how much the typical day of children has changed during lockdown. There was a decrease in “productive” activities such as school, homework and extracurricular activities and an increase of “non-productive” time, including TV, passive screen time, social networks, and others. Kids between 3–10 years old already spent 1.5 hours per day watching TV and up to 2 hours for older kids. During lockdown the children watched approximately the double than before lockdown. The average of the educational progress rated by the parents of children was approximately 4.8 on a scale from 0 to 10. It’s notable that there was a substantial heterogeneity by school level and by whether the school implemented live online classes. Furthermore, the results confirm a decrease of children’s emotional wellbeing during the lockdown, while the children’s personal relationship with their parents slightly improved. The negative effect on children’s wellbeing was significantly smaller when the father was the main caregiver.

Spitzer and Musslick (2021) investigated how school closures in 2020 influenced the performance of German K-12 students in a curriculum-based online learning software for mathematics (i.e., Bettermarks). Data from more than 2500 students on over 124000 mathematical problem sets before and after the shutdown in Germany were analyzed. Results showed that contrary to the expectations, students’ performance increased during the shutdown of schools relative to the year before: the relative error rate significantly decreased by 2.43% during the school shutdown

compared to the same time window in the previous year ($p < .001$). More repetitions ($p < .001$) and more total assignments ($p < .001$) led to lower absolute error rates. Additionally, low-achieving students showed greater improvements in performance than high-achieving students, which indicates a narrowing gap in the performance between low and high-achieving students contrary to the predictions. Results from this study stand in contrast to earlier findings showing mostly detrimental effects of school closures on the performance of students.

Koenig et al. (2021) compared self-reported emotional and behavioral problems, depression, suicide thoughts and eating disorders in a matched sample of German adolescents (12-20 years) using pre-pandemic data (November 26th, 2018 to March 13th, 2020; $n = 324$) and lockdown data (March 18th, 2020 to August 29th, 2020; $n = 324$). They did not find an impact of school-closings on adolescents' mental health with the exception of decreases in suicide plans ($OR_{adj} = 0.31$, 95% CI [0.13, 0.75], $p = .009$) and decreases in conduct problems in the post-lockdown period ($b_{adj} = -0.16$, 95% CI [-0.31, -0.00], $p = .045$). Family risk-factors did not moderate these findings. The influence of socioeconomic status on emotional and behavioral problems as well as depression decreased during the lockdown. These results are not in line with other findings showing an increase of mental health problems during the lockdown.

Thorell et al. (2021) investigated the effect of COVID-19 on parental experiences of homeschooling children between 5 to 19 years. The sample included 6720 parents (parents with a child with a mental health condition (MHC), $n = 2002$; children without MHC, $n = 4718$) from 7 different countries in Europe. The data collection with an anonymous digital survey took place between April 28th and June 21st, 2020. More than one-third of the parents reported that they felt the school's support was insufficient (MHC: 45.1%; NON-MHC: 36.8%). In all countries (except of Sweden) parents in both groups reported that they were more negatively affected by homeschooling than their children. The MHC group reported more negative experiences, but also more positive experiences, compared to the NO-MHC-group. Parents of children with a mental health condition reported more often that their child felt socially isolated compared to parents with mental health condition.

In a qualitative study from Scotland, Couper-Kenney and Riddell (2021) examined the extent to which the rights of children with additional support needs and disabilities (ASND) have been prioritized during the COVID-19. Between June and July 2020, they assessed 16 families including a total of 24 of children between 4 and 18 years old with ASND. Parents reported difficulties with internet access, navigating the new online systems and the stress to meet the children's individual

learning needs. Families reported different experience regarding the support from the school. Some were disappointed, wished for more appropriate work and active contacting. Other parents reported a higher degree of responsive communication from the school. They especially appreciated weekly calls from the teachers. They also reported mixed feelings about the general impact of the lockdown on education. Some of them, especially parents of older children feared the missing learning and exams. Others saw a positive chance in home schooling. Due to COVID and the avoidance of all outside contacts, parents and siblings had to take care of the child, since the personal assistants couldn't go to their home anymore. Parents reported that this was especially challenging for siblings. They had to carry out more physical and emotional care. Regarding the impact on children's mental health, parents reported both, negative and positive effects. Most of the families reported poorer mental health due to missing peers, missing other activities, and confusion about the situation. Some of the children were happier and more eager to study and experienced less school-generated stress.

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).

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.

An online cross-sectional survey (Dondi et al., 2021) was filled in by 730 families living in Italy with children up to 18 years old. About distance learning, responses indicated that children with learning disabilities were more likely to experience sadness, nervousness, or trouble ($p < .001$) and, in parallel, had more difficulty in paying attention during distance-learning classes ($p < .001$).

Scarpellini et al. (2021) explored the experiences in organizing school for children at home and its implications on children's psychological well-being. A cross-sectional, observational study using an online questionnaire was conducted from May 8th to 15th, 2020. It targeted mothers of children aged 6 to 15 years old ($N = 1601$). The children's attitude towards distance learning varied between primary and middle school students: 28.3% of the primary school students could not pay attention for more than 20 minutes ($OR = 2.39$, 95% CI [1.75, 3.25]), 21.6% needed a break every 10 minutes ($OR = 2.25$, 95% CI [1.53, 3.30]), 40.6% showed a lower quality of learning ($OR = 1.63$, 95% CI [1.29, 2.07]) and 48.3% presented restlessness during video lessons ($OR = 1.37$, 95% CI [1.10, 1.72]). Furthermore, results also revealed that more than half of the middle school students had a minimum of 2 hours screen time for video lessons per day (59.5%) and for other things than distance learning (51.1%). For 2% of the students an abuse of media use with 8 to 12 hours of screen time was reported. Most mothers (60.2%) reported behavioral changes in their children, particularly in the youngest ($OR = 1.39$, 95% CI [1.11, 1.73]). The most frequently reported symptoms were restlessness (69.1%) and aggressiveness (33.3%) in the youngest and anxiety

(34.2%) in the oldest. The level of restlessness and aggressiveness was higher in primary school children compared to middle school children ($OR = 1.72$, 95% CI [1.26, 2.44]; $OR = 1.50$, 95% CI [1.06, 2.10]).

Egan et al. (2021) analyzed data from a study of 506 parents of children aged 1 to 10 years in Ireland who completed the online Play and Learning in the Early Years (PLEY) survey during the lockdown in May and June 2020. Parents were asked a series of questions about their child's play, learning, and development during the lockdown and the impact of the restrictions on their children's lives. Results showed that most children missed their friends, playing with other children, and the routine and structure of the early childhood education and care (ECEC) and school settings. Regarding gender, girls had higher scores than boys for missing school ($U = 15,89$, $N = 385$, $p = .014$) and for missing their friends ($U = 26,986$, $N = 501$, $p = .003$). No significant gender differences were found for missing playing with other children, ($U = 29,155$, $N = 503$, $p = .123$), or for missing childcare ($U = 9959$, $N = 287$, $p = .701$). Younger children, aged 1 to 5 years, had significantly higher scores for missing ECEC than children aged 6 and over ($U = 6850$, $N = 283$, $p < .001$), although they had lower scores for missing friends ($U = 23,339$, $N = 493$, $p < .001$). Furthermore, parents described the negative effects of the lockdown on their children's social and emotional well-being, which they felt led to tantrums, anxiety, clinginess, boredom, and under-stimulation. However, some parents reported positive aspects of the lockdown for their children and family, including more time to play with siblings and a break from the usual routine.

A study from Quenzer-Alfred et al. (2021) examined how preschoolers' basic school skills in language and math developed during the nursery shutdown due to the COVID-19 pandemic in Germany. The sample consisted of 49 children (aged between 5 and 6 years) who were evaluated in a single-group pre-post-test design with five subtests of the Intelligence and Development Scales 2 (IDS-2) before and after the closure of nurseries and semi-structured group conversations. Furthermore, guided interviews with professionals and parents were conducted. The results showed that the children's basic school skills differed significantly before and after the shutdown. There is a highly significant decrease of the overall basic school skills between pre- and post-data medians ($\Delta r = .64$). Comparing changes over time, language skills showed the most significant overall effect ($\Delta r = .72$), characterized by strong effects in expressing language skills ($\Delta r = .67$), phoneme analysis ($\Delta r = .58$), and a medium effect in phoneme-grapheme correspondence ($\Delta r = .47$). Only language comprehension ability did not change significantly over time ($\Delta r = .03$). With respect to mathematical thinking, a medium effect between pre- and post-data collection was observed ($\Delta r =$

.41). Consistent with the quantitative results, children's perceptions of school show "fear of not being able to learn to read and write, the fear of punishment for failure, the fear of teachers in general, the fear of disciplinary action, the fear of poor school performance and the fear of not being able to make (enough) new friends." Focusing on the interviews with nursery professionals and parents, the data shows a positive view of the situation. The general perception of the nursery professionals is that the closure had no real negative impact on the children or on their learning progress, experiences, and social development.

A cross-sectional study investigated the health consequences for adolescents and young adults during the back to school period between October 15th and November 8th, 2020 in Portugal using a mixed-method approach (quantitative survey with open questions). 304 secondary school or university students aged 16 to 24 years ($M = 18.4$ years) participated in the study. Results in connection to the confinement effects in the back to school period showed that 43.8% perceived the new school reality in a more pessimistic way, although 28.1% considered it positive or without significant changes (28.1%). In academic performance, 57% of participants considered that it had negative effects, 11.1% positive and 31.9% that it did not affect this component. Females and university students reported more often that they perceived the new school reality in a pessimistic way. In fact, the "new school reality" affected the target groups mental and physical health as well as their social life. As authors claim, this is so far the only study "giving voice" to the target group under the back to school reality (Branquinho et al., 2021).

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, substance dependence 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 on only child families and families with siblings as well as 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, a study from Germany observed that children from families with low education levels, or less than 20 square meters of living space per person, or a migration background were substantially more burdened by the COVID-19 pandemic than their peers. They displayed lower self-reported health-related quality of life as well as more mental health problems, emotional symptoms, conduct problems, hyperactivity and peer problems as well as more anxiety, depressive symptoms, and psychosomatic complaints. These findings are in line with initial studies indicating that families with low socio-economic background or a migration background were more negatively affected by the COVID-19 measures. [For instance, a study from Spain observed that, compared to data from before the pandemic outbreak, 8-18 year-old children and adolescents from the welfare system or at-risk families had worse psychological wellbeing, with adolescents having a worse wellbeing than younger children.](#) However, depending on the domain, also higher socioeconomic status can be associated with negative outcomes. A study from Italy observed that parental stress has been increase in SES not-at-risk families which was in turn associated with more child regulation problems. Regarding the build environment, living in a house and having a large garden during the lockdown were associated with less conduct problems in children such as hyperactivity/inattention.

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. In addition, a study on Albanian nursing and midwifery students pointed to increased depression levels such that more than a quarter of students reported moderate to severe depression symptoms during the lockdown.

Number of publications: 28

Results

Families with social vulnerabilities

Among the vulnerable groups that were covered in the sections above were - among others - children with physical and mental health problems such as diabetes (Christoforidis 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; Kaya Kara et al., 2021), eating disorders (Graell 2020), Autism Spectrum Disorder (Berard et al., 2021; Colizzi et al., 2020; Lugo-Marín et al., 2021; Meral, 2021; Mumbardó-Adam et al., 2021), and substance dependence (Skumlien et al., 2021). In addition, there are also other vulnerability factors such as single parenthood or being an only child relative to being a child with siblings (Christner et al., 2021), cancer (Güney et al., 2021), Special Educational Needs and Disability (SEND; Asbury et al., 2021), handicaps (Celik, 2021) 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). A study from Italy (Spinelli et al., 2021), however, found that parents from SES not at-risk families reported higher levels of parental stress in response to COVID-19 compared to SES at risk families. This increased parental stress in SES not at-risk families was associated with more children emotion regulation problems. With respect to the living situation, children who live in a house rather than an apartment and those who have a large garden at home rather than no large garden showed less conduct problems such as hyperactivity/inattention (Christner et al., 2021).

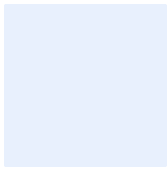
In the COPSYS study (see above), Ravens-Sieberer et al. (2021), a high-risk group analysis explored the COVID-19 effects on children from families with (i) low education levels, or (ii) less than 20 square meters of living space per person, or (iii) a migration background. They were “considered to be at a high risk of suffering a sizable impact due to the COVID-19 pandemic when the family climate, as a resource, was also low (the lowest 20% of all respondents). These high-risk children and adolescents ($n = 126$) reported being substantially burdened by the COVID-19 pandemic significantly more than their peers [42.5% (53.3–31.7) vs. 26.7% (29.4–24.4%), $p = .005$] and displayed lower self-reported health-related quality of life (d -ES = 0.67; $p < .001$) and more parent-reported total mental health problems (d -ES = 0.83; $p < .001$), emotional symptoms (d -ES = 0.59; $p < .001$), conduct problems (d -ES = 0.84; $p < .001$), hyperactivity (d -ES = 0.60; $p < .001$) and peer problems (d -ES = 0.47; $p < .001$) as well as self-reported anxiety (d -ES = 0.37; $p < .001$), depressive symptoms (d -ES = 0.64; $p < .001$), and psychosomatic complaints (d -ES = 0.67; $p < .001$).

Vallejo-Slocker et al. (2020) investigated the psychological impact of the COVID-19 pandemic on 459 vulnerable children and adolescents from the welfare system or at-risk families in Spain aged 8-18 years ($M_{\text{age}} = 13.13$; $SD = 2.68$; 51.4% male) using the Strengths and Difficulties Questionnaire (SDQ) and KIDSCREEN-10 index. Regarding gender, females had higher scores than males in the SDQ emotional subscale ($p < .001$) and the KIDSCREEN-10 index ($p = .021$), indicating worse functioning. Whereas no age differences were observed in the SDQ, in the KIDSCREEN-10 younger children aged 8-11 years ($n = 133$) scored higher than the older children aged 12-18 years ($n = 326$), indicating better functioning in the younger children. When comparing the study sample to the 2017 SNHS evaluating the general population of children in Spain before the pandemic outbreak, results show that the children and adolescents in this study had worse psychological wellbeing than those in the 2017 Spanish reference.

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, 2.38], $p = .011$). However, overall, this specific cohort did not differ from the others (Topriceanu et al., 2021).

The aim of a cross-sectional study conducted in Albania (Mechili et al., 2021) was to evaluate the depression levels of nursing students, midwifery students and their family members' during the quarantine period. Data from March 30th to April 9th, 2020 was analyzed. A total of 863 students



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(age: >18) and 249 family members (age: 18 to 85) were included. "The mean PHQ-9 score for the students was 6.220 ($SD = 5.803$) and for the family members was 6.280 ($SD = 5.857$)." More than a quarter of both populations were above the threshold of $PHQ-9 \geq 10$, indicating moderate to severe symptoms of depression.



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