

Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults - 03.09.2021 - 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/continuous reporting

The final report will include an abstract covering all topics. For the moment please refer to the abstracts of each topic.

Intermediate reports refer to the literature identified and read at the time. New literature is inserted in blue (peer-reviewed literature) or light grey letters ("grey literature": reports), while literature already included in the previous reports is black or dark grey, respectively. Changes to the topic abstracts are visualized accordingly.

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Preamble

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

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Background

The COVID-19 pandemic is an unprecedented global public health crisis touching the whole population in different ways. Since the beginning of the pandemic containment measures and policies have been implemented to curb the epidemics. Driven by the scenario of an exponential epidemic and overburdened health system, the Swiss government ordered different containment policies and hygiene recommendations. Current but still limited evidence indicates that children and adolescents have an equally high attack rate, but luckily are at far less risk to contract severe COVID-19. However, more and more research indicate 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?
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Methodology

The literature search spans the period January 1st, 2020 until the end of the project. Three literature data banks are accessed to identify relevant literature: PubMed (biomedical literature), Embase (biomedical), and PsycInfo (psychological literature). A search string was defined and tested based on the study questions and outcomes of interest (see attachment). The search string was adapted to the three literature data banks, which provide different features for selective searching. For the scientific literature prior to the start of the project, we could resort to existing results of a systematic literature search by the EUPHA section Child and Adolescent Public Health directorate (CAPH) with the same outcomes and exposure in the age-group 0 to 18 years for the time from January 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 is conducted weekly, literature is exported into Rayyan (www.rayyan.qcri.org/), an open systematic literature search software, and screened for inclusion. Screening is performed by one researcher; in case of questions a second opinion is requested. Inclusion criteria are data on children, age 0 – 25 years, exposure related to pandemic policies or containment measures, outcomes according to study questions, and study data from European continent. Publications without any data collected during the pandemic or publications without primary study data and peer-review such as guideline papers, letters or opinion pieces are excluded. Web of Science is searched monthly. Included publications are categorized and rated and relevant results extracted in a programmed Excel sheet by a researcher. Quality rating (yes, no, partly) is based on three questions: 1. “Was the study sample clearly described?” 2. “Were confounding factors identified or discussed?”, and 3. “Were outcomes measured in a valid and reliable way?”. All studies included in the narrative review are considered of sufficient quality. If quality issues should limit the interpretation of the results, such issues will be reported alongside the publication.

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

Results and Findings

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

Summary

Overall, there is still limited evidence on physical activity and nutritional behavior based on longitudinal data. Most studies are cross-sectional, collect pre-covid data retrospectively and sample size is often small.

With these caveats in mind, current evidence points to a decrease in physical activity during confinement at home and during the lockdown in general. While the report includes articles covering the age range of interest (0 - 25 yrs.) data is still insufficient to evaluate differences across child, adolescent and young adult age groups. 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.

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.

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

Number of publications: 38

Time period: Jan 2020 to September 2021, single publications from March to July 2021.

Results

Physical activity and screen time

A total of 89 Spanish adolescents, 12 and 14 years old (SD 0.9) and 49.4% girls, participated in the 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 (VO₂) in relation to what is expected for their age. Average VO₂ max before COVID-19 confinement was 46.2 ml.kg⁻¹ .min⁻¹ (SD 0.6), whereas the average VO₂ max after COVID-19 confinement was 45.7 ml.kg⁻¹ .min⁻¹ (SD 0.7), with an estimated difference of - 0.5 ml.kg⁻¹ .min⁻¹ (SD = 0.3) ($p = .12$) between November 2019 and November 2020. Subgroup analyses estimated a significant VO₂ max reduction for the subgroup of girls (- 1.0 ml.kg⁻¹ .min⁻¹ (SD 0.4) ($p < 0.05$)), particularly girls aged 14 years (- 1.5 ml.kg⁻¹ .min⁻¹ (SD 0.6)), and an improvement in boys aged 14 years (+ 0.4 ml.kg⁻¹ .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-square = 33.433, $p < 0.001$).

The Italian longitudinal study from Maltoni et al. (2021) in an outpatient population of obese children ($N = 51$, mean 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 behaviour (SB). Data were collected during 2 months before March 8th and between May 18th till the end of June 2020. A general weight gain during lockdown was observed (2.8 ± 3.7 kg ($p < .001$)). 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; $p < .001$) Males gained significantly more weight (3.8 ± 3.4 kg vs 1.2 ± 3.7 kg, $p = .02$) and increased the hours of SB significantly compared to the females ($+3.8 \pm 2.7$ h/day vs $+1.5 \pm 2.5$ h/day; $p = .003$).

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 23 and April 1, 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 ($p < 0.001$). There was a significant negative association between play without physical activity and age ($p < 0.001$), decreasing with age after age 3-5 year, and sex ($p < 0.001$), increased in girls. Overall physical activity and sedentary time was only associated with age ($p < 0.001$).

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 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)

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>

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 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 (Mean 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

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: 9 April to 10 May, and second stage: 11 to 23 May). 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

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

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 (mean: 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. 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 et al., 2021). A cross-sectional study in south Italy (Pisano et al., 2021) collected data from a convenient sample of 326 adolescents (*Mean males* = 18.8 years, *SD* = 1.3; *Mean 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 prepandemic 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)

This Turkish study from 2021 (Bucak et al., 2021) investigated the different sleep habits between children of health workers (group 1 = 122 n) in a tertiary hospital and non-health workers (group 2= 250 n) 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 (<0.001). 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 (mean age: 8.1; SD: 2.62) filled out an online survey which covered sleep and insomnia. 1) Sleep: When it comes to bed-time 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 parents 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, $p < 0.001$) 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 prepandemic 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 first of May to 10th of June 2020 (15.5% were from Europe). Compared to before the pandemic, bedtime was significantly later on weekdays and weekends ($p < .01$) and children woke up later during COVID-19 than before ($p < .01$). The median sleep duration score on weekdays increased significantly ($p < .001$), while

there was no significant change during the weekend ($p = .51$). Impact on sleep differed by age group: 14- to 17-year-olds showed an increase in sleep duration on weekdays, 3- to 5-year-old children a decrease in sleep duration on weekdays and weekends. There was a significant increase in screen time in all age groups ($p < .001$). Increase in sleep duration on weekdays was borderline significant ($p < 0.057$, $N = 106$) in the European sub-sample (Kaditis et al., 2021).

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

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

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 ($SD = 0.19$)) 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 (baseline age 13.6 ± 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)

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 (mean 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 et al., 2021).

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

A change in health care utilization is reported consistently by studies early in the pandemic, mostly investigating the lockdown in spring. They consistently show a large decrease in emergency department (ED) visits during the lockdown, however, the reduction rates in ED visits vary a lot across the studies. These studies mostly rely on hospital or other registry data, but subjective perception on negative changes regarding health care provision and access is also reported. Post-

lockdown data is less abundant but indicate no significant catch-up of visits. Evidence of patients presenting themselves with higher severity scores is increasing and authors imply parents' hesitancy to present their child. Regarding different diagnoses, most studies agree in a reduction of trauma and injuries, as well as a change in demographic characteristics of trauma/injured patients and associated causes. Evidence is however increasing on more household trauma, such as ingestions, falls and refer to physical abuse. Some diagnoses seem to have gone "missing", i.e. patients do not present themselves with these diseases, mostly infectious disease related diagnoses. Initial evidence is presented on an increase in mental health diagnoses in ED. 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.

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

Number of publications: 72

Time period: Jan 2020 to September 2021, publications from March to July 2021.

Results

Impact on body weight

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 (Mean age 14.7 (SD:2.1 years)) were collected within 2 months before 8 March 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 ($p < 0.001$)). The hours of mild physical activity reduced ($+2.9 \pm 2.8$ h/day; $p < 0.001$) and the hours dedicated to SB decreased (-1.0 ± 1.6 h/ week; $p < 0.001$) 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 behaviour 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

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

Vaccination:

Mc Donald 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.

Specific diseases

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

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).

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 (Passani 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 ($p = .017$).

Christofordis 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 glycemic range (TIR) increased by 10% during the lockdown period compared to the control period, from 49% to 59% ($p < 0.001$). 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 ($p < 0.001$). 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 ($pH < 7.1$) 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 (24th February 2020 - 24th May 2020) and compared to data from the preceding 90 days (25th November 2019 - 23rd February 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) ($P < 0.05$). 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 ($p = .006$).

A 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 ($M_{\text{age}} = 15.0$ 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.

Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults - 03.09.2021 - Julia Dratva, Frank Wieber, Simona Marti, Anthony Klein Swormink.

A sample of $N = 1'983$ 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** ($n = 85$), $M = 4.2$ years ($SD = 1.1$) compared data from before the pandemic data with pandemic data (Nov. 2019 to Oct. 2020) and observed a significant clinical improvement during the lockdown. Families reported a dramatic drop in wheezing episodes (V1: yes = 51; V2: yes = 0, $p < .001$). There were also significant reductions in the day and nighttime symptoms, including episodes of shortness of breath ($p < .0001$). The use medication dropped significantly ($p < .001$). Finally, patients had significantly fewer extra medical examinations, as well as fewer emergency room visits ($p < .0001$). Outcomes worsened significantly again after lockdown (Ullmann et al., 2021).

An Italian study (Di Riso et al., 2021) investigated asthma control and children's and mothers' psychological functioning in 45 **asthmatic children** aged 7 to 14 years ($M_{Age} = 10.67$; $SD_{Age} = 2.29$), compared to a healthy control sample matched for age and gender ($N = 41$; $Mean_{Age} = 11.02$; $SD_{Age} = 2.25$). An online survey was conducted after the lockdown from May 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

(± 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

A French study investigated the effect of the pandemic on 92 children with psoriasis between June 10 to June 29, 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 ≥ 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 ($p < 0.0001$) during the pandemic (mean 454 $\mu\text{mol/l}$, SD ± 252 , vs. 556.4 $\mu\text{mol/l}$, SD

± 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.

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 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 (mean 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, ($p > 0.05$), and 0.71 (±0.46,) diopters in 2020 during home education. The increase in MP in 2020 compared to 2019 and 2018 was statistically significant ($p < 0.003$). 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 of health services (hospitalizations or primary care & preventive care)

Many countries experienced a change in utilization of health services, partly due to recommendations to postpone health care appointments, reorganizations of wards and departments to cope with COVID-19 patients, or the closing of specific services altogether. [Studies indicate an impact on pediatric care \(Agostini et al., 2020\)](#), [diagnostic procedures \(Buyuksahin et al. 2021\)](#).

Overall, most studies yield evidence that contacts for most medical conditions were lower than in comparative time periods (Mansfield et al., 2021). Some 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 parents (Paulauskaite et al., 2021). This suggests that patients avoided health services out of fear of infection and stay-at-home rules.

A study in the UK examined primary care contacts for almost all conditions using de-identified electronic health records from the Clinical Research Practice Datalink (CPRD) Aurum (2017 $N_{11-20} = 1'233'387, N_{21-30} = 1'455'550$; 2018 $N_{11-20} = 1'283'296, N_{21-30} = 1'499'066$; 2019; $N_{11-20} = 1'319'983, N_{21-30} = 1'517'439$; 2020 $N_{11-20} = 1'325'412, N_{21-30} = 1'505'172$). Between 2017 and 2020, they calculated weekly primary care contacts for selected acute physical conditions: asthma exacerbation, chronic obstructive pulmonary disease exacerbation, acute cardiovascular events (cerebrovascular accident, heart failure, myocardial infarction, transient 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 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 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.

Polcwiartek et al. (Polcwiartek 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%)(Paulauskaite et al., 2021).

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 (Chi-squared P-value < .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 (1. March to 31. May 2020) and compared it with data from the previous year (1. March to 31. 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 ear, 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 number 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 1. March 2020 until 30. 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, $p = .13$).

In a Turkish pulmonary policlinic 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

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 were significantly reduced ($p < 0.01$) 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 (mean = 12.8 years). The longitudinal study compared data which was collected before (September 2012) and during COVID-19 (July 2020). The real-life compliance rate before COVID-19 (measured data from September 2012 to March 2020) was 86.1% (173 out of 201 patients). Overall, there were 28 dropouts. During COVID-19 (measured data starting from mid-March 2020) there was a total of 108 participants who continued to receive SCIT. The real-life compliance rate during COVID-19 was 71.3% (77 out of 108 participants). The total dropouts were 31. The most frequent reason for drop-out was fear of being infected with COVID-19 (35.4%), followed by the belief that the SCIT practice stopped due to the COVID-19 pandemic (29%). Male gender (OR: 2.972, 95% CI [1.132, 7.804], $p = .027$) and higher age (OR: 1.209, 95% CI [1.064, 1.375], $p = .004$) were found to be the independent risk factors for drop-out during the COVID-19 pandemic. (Aytekin et al., 2021)

Kahraman et al. (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; mean age: 12 (\pm 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.

Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults - 03.09.2021 - Julia Dratva, Frank Wieber, Simona Marti, Anthony Klein Swormink.

Impact on emergency department hospital visits

Emergency department visit decreases were observed in many hospitals. According to a study in Italy (Comelli et al., 2020), emergency department visits in the youngest age groups declined (0 – 12, 13 – 18) while visits by adults and older age groups increased. Agostini et al. (2020) (Italy) describe a significant decrease in admissions in the pediatric emergency unit after the beginning of the lockdown phase. The percentage of decrease in emergency department varied greatly. The mean number of cases presenting daily at the pediatric emergency unit during lockdown was ~28% of those presenting during the same period of the previous year (on average 20 vs. 69 patients per day), while Cozzi et al. (Italy) report a decrease in visits by 77.5% (Cozzi et al., 2020), Liguoro et al. (2021) by 73% (Italy) and Molina-Gutiérrez et al. (Spain) by 65.4% (Molina Gutiérrez et al., 2020) compares to the same period of 2019, which confirms the effect of lockdown.

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 to 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 (Ilari Kuitunen 2021).

Bailhache et al. (2021) who also found that during lockdown the number of pediatric emergency department visits ($N = 3227$) was 60% lower than the predicted number of 7519 visits based on pre-pandemic data, and point to a large drop in infectious and respiratory disease cases (Bailhache et al. 2021). A study from Portugal (Paiva et al., 2021) comparing data from March 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.

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

An Italian cross-sectional study (Curatola et al., 2021) examined the medical charts of all children under 2 years of age admitted to the emergency department (ED) between February 2020 to February 2021 in comparison with the same period in the 5 previous years. During the outbreak of COVID-19 there was reduction of 42% emergency visits overall, while the number of bronchiolitis cases dropped by 84%. Among the children with acute bronchiolitis significantly more were

admitted as “Emergency” (18.2% vs. 4.9%, $p < .05$) and “High Priority Consultations” during COVID-19 (48.5% vs. 38.8%, $p < .05$). No significant differences were found concerning the rate of hospitalization, but the admission to PICU was zero compared with 4.7% in the 5 previous years ($p < .05$).

Rotulo et al. (2021) describe the rate and types of community-acquired respiratory infections observed in a pediatric Emergency Department during March 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.

An international study (Papadopoulos et al., 2020) evaluated that 47% of the participants reported that their clinics did not accept/receive new patients during the epidemic (exception participants

from Asia). Between 39% and 60% of the participating practices have even ceased physical appointments. In addition, there is also a reduction in the frequency and/or the total number of patients monitored (median 35 cases (IQR, 20 – 60)). Ninety percent of the participating centers have launched virtual online or telephone consultations to substitute or complement clinical visits, while 73% have used a helpline to address the needs of their patients. Within each practice, a median of 70% (IQR, 60% – 80%) of evaluated patients were well controlled.

A descriptive and retrospective study from Turkey (Akkoç et al., 2021) compared the burn cases in a University hospital burn unit between 16 March and 30 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 and 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 ($p < 0.001$).

Most cases occurred in 1 and 5-year-olds (2020: 67.3%; 2019: 38.6%; 2018: 59.1%).

Impact on self-injury

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

Physical, sexual abuse

An increase of cases was evidenced in a retrospective analysis of referrals from a hospital's children's social care (CSC) in the UK (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

Children, adolescents, and young adults are worried. Almost all high school students in Switzerland were afraid of infecting their parents/grandparents or another close person belonging to a risk group and about one third of respondents to the Swiss Corona Stress Study have at least a moderate to severe fear of suffering from Long-COVID in case of infection. 15- to 34-year-olds also indicated that the fear of the future had become particularly important to them.

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.

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. The fact that sharing thoughts and feelings about COVID-19 with others was the most frequently reported coping strategy for COVID-19-related problems also highlights the importance of social contacts as a coping strategy to sustain one's mental health. About half of young adults reported to use this strategy, whereby females mentioned it more frequently than males.

Particularly during the first lockdown period but also during the second wave in November 2020, and the third wave in March 2021, the psychological well-being and global health of children, adolescents, and young adults decreased, and distress, anxiety, depression, fatigue, tiredness, and general psychopathology increased. For instance, depression, anxiety and loneliness were higher in adolescents and young adults in May and June 2020 than in 2018. 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- to 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.

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 are perceived family stress and instability. Further, adolescents' 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. 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. Studies on alcohol consumption are inconclusive. Whereas some studies observed a reduction in alcohol consumption and that binge drinking 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". 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), ASD (Autism Spectrum Disorder), as well as cystic fibrosis, primary ciliary dyskinesia, and asthma showed effects on well-being and social relations, however, there is a greater variance with respect to the direction of the 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 or social situations for children with ASD), others experience decreases as external support is reduced (e.g., local health services, school or private therapist) and an aggravation of symptoms such as repetitive movements. Over the course of the pandemic, younger children showed 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.

Regarding emotional difficulties and externalizing behaviors such as hyperactivity/inattention, several studies observed increases 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.

For children with cancer, children's occupational performance, satisfaction and quality of life decreased significantly between April and September 2020 and their participation in neighborhood and community participation and participation in community living activities decreased. Also, Special Educational Needs and Disability families felt a lack of support and 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, one large-scale UK study observed that primary care contacts was decreased during March to July 2020 relative to the pre-pandemic period. This was true for anxiety, depression, self-harm (fatal and non-fatal), severe mental illness, eating disorder, and obsessive-compulsive disorder, but not for acute alcohol-related events that remained stable. Although the frequency of primary care contacts recovered it did not attain pre-lockdown levels. Another study from France also observed that compared to 2019, the number of overall and

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mental health specific consultations decreased in January to February 2020 (ca. 5 to 15%) and increased again in March to June (ca. 5 to 20%) with about half of the consultations in March and May and all consultation in April being teleconsultations. A study from Denmark also observed that the contact 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. Psychologists at a pediatric hospital reported 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.

Number of publications: 74 (53 in June, 40 in May; 26 in April; 14 in March)

Time period: Jan 2020 to September 2021, single publications from March to July 2021.

Results

Worries and social contacts

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 (IQR)

was [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).

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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 as a result of the corona crisis. The results show that the negative impact of the corona pandemic on mood was most pronounced among participants aged 15 to 24 years. Overall, 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

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 ($p > 0.05$).

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 $ps < 0.01$. 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

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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%; $p \leq .001^{**}$).

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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 (1.55 – 2.46) and fewer children reported poor global health (RR = 0.36 (0.20 – 0.65)). Associated factors with worse mental/social health were single-parent family, three children in the family, negative change in work situation of parents due to COVID-19 regulations, and a relative/friend infected with COVID-19. A large majority (>90%) reported a negative impact of the COVID-19 regulations on daily life.

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 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 CL 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 negatives changes (26.1%) than all other age groups (between 11.1% -19.1%, $p = <.001$) in their exercise behavior. Individuals who had a negative change in their exercise behavior between before and during initial COVID-19 restrictions reported poorer mental health and well-being; a relationship that was evident across all countries investigated (Faulkner et al., 2021).

A longitudinal study in Spain examined the effects of the pandemic and confinement on the mental health of the general population over 18 years. Data was collected from March 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 ($r_{pb} = 0.14$, $p < .001$) and whether the baby's birth was before or during COVID-19 ($r_{pb} = 0.09$, $p < .005$). Moreover, impaired mother–infant bonding was positively and significantly associated with anxious symptoms ($r = 0.28$, $p < .001$), depressive symptoms ($r = 0.36$, $p < .001$), and parenting stress ($r = 0.66$, $p < .001$) (Fernandes et al. 2021).

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, $ps < .001$, ds range from 0.35–0.41. On the other hand, children’s free time and family life turned more positive, $ps < .001$, ds 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, 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, CI; 1.26 - 2.44; OR = 1.50, 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)

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 statistical significant differences by age group in perceived changes to eating or exercising behavior. People with current/past eating disorders reported significantly more difficulties in regulating eating (Robertson et al. 2021).

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

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

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

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

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)

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.

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

In total, answers of 533 parents of children with ADHD were included in the analysis of this study from France. The vast majority of responders were women 95% (95% CI [93.50, 97.18]), children mean age was 10.5 (95% CI [7.58, 13.44]). Since the lockdown, 34.71% of children experienced a worsening in well-being, 34.33% showed no significant changes and 30.96% (95% CI [27.09 – 35.10]) were doing better according to their parents. The thematic analysis showed that an improvement of their children’s anxiety was one of the main topics addressed by parents. This improvement related to less school-related strain and flexible schedules that respected their children’s rhythm. Improved self-esteem was another topic that parents linked with a lesser exposure of their children to negative feedback (e.g. in school environment). On the other hand, parents reported a worsening of general well-being in their children, and this manifested as oppositional/defiant attitudes and emotional outbursts (both can be typical for behavior in the

context of “ADHD”). In addition, doing school-task at home and learning for school was difficult for some children, according to their parents. The lockdown situation raised parents’ awareness of the role of inattention in relation to ADHD symptoms in the context of their children’s learning difficulties. Furthermore, a “shift to the digital” world has been described, children suffered from not being able to meet their classmates in person, hence their spending more time on social media and playing video games (Bobo et al., 2020).

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 behavioural 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/carer 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.

Literature screening report: Secondary health impact of COVID-19 containment measures in children, adolescents, and young adults - 03.09.2021 - Julia Dratva, Frank Wieber, Simona Marti, Anthony Klein Swormink.

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

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 the 17 and July the 17 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 to 18, $N = 354$). Doctors established the status using a common method (Clinical Global Impression Improvement) on a weekly basis. Most children's and adolescents' mental health status remained stable of the course of the 8 weeks. 23 to 33 % of patients showed an improvement over the course of the weeks, albeit the majority a minor improvement, and 22 to 30% showed a deterioration, again mostly minor deterioration of their mental health status (Lavenne-Collot et al., 2021).

Children with chronic diseases and mental health impact

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

A 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 ($M_{age} = 8.9$ 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, $p < 0.05$. 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 $M = 3.8$ ($SD = 1.3$).]

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 ($Mean\ age = 10.67$; $SD\ age = 2.29$). They investigated asthma control (see section on physical health) and children's and mothers' psychological functioning after the lockdown from May 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

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

LGBTQ+

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

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

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. Also, children with learning disabilities did experience difficulties during distance learning classes and were more likely to be sad, nervous, or troubled.

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).

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.

For older children, restlessness and anxiety were issues that accompanied distance learning. [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 based on only on a limited number of studies, the results should be interpreted with caution.

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Number of publications: 8 (7, in June; 3 in May)

Time period: Jan 2020 to September 2021, single publications from March to July 2021.

Results

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

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

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 [χ^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, CI; 1.75-3.25), 21.6% needed a break every 10 minutes (OR 2.25, CI; 1.53-3.30), 40.6% showed a lower quality of learning (OR = 1.63, CI; 1.29–2.07) and 48.3% presented restlessness during video lessons (OR = 1.37, 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, 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, CI; 1.26 - 2.44; OR = 1.50, 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

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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. 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: 30 (29 in June; 24 in May; 19 in April)

Time period: Jan 2020 to September 2021, single publications from March to July 2021.

Results

Families with social vulnerabilities

Among the vulnerable groups that were covered in the sections above were children with physical and mental health problems such as diabetes (Christofordis et al. 2020; Rabbone et al., 2020), chronic lung diseases (Di Riso et al., 2021; Eyuboglu et al., 2021; Havermans et al., 2020), congenital heart disease, very preterm-birth (Ehrler et al., 2021), cerebral palsy (Cankurtaran et al., 2021), ADHD (Bobo et al., 2020; 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., 2020) or LGBTQ+ (Gato et al., 2021).

In term of the role of contextual variables, results from a Spanish study on lifestyle behaviors showed that children from families with social vulnerabilities (for example mother with non-Spanish origin or a low educational level, low socioeconomic status) were more negatively affected by the COVID-19 confinement (Medrano et al., 2021). 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 COPSY 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; $p < .001$).

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 (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 ≥ 10 , indicating moderate to severe symptoms of depression.

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