Literature screening report

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

Report submission date:	**16.07.2021**

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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.

Content

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.

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?

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 PsyInfo (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, ScolarMed, 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. However, 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. The increase in sweet foods during the lockdown found by some authors is inconsistent, more consistency is found 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 in increasing nutritional inequality. 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.

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: 23

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

Results

Physical activity and screen time

A high prevalence of **physical inactivity** among adolescents (10 – 19 years), before and during lockdown, was reported by Ruiz-Roso et al. (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) found that older individuals reported that they were more physically active than younger subjects (p < .001).

A multi-country cross-sectional study (UK, IRE, NZ and AUS; N = 8425, M = 44.5 years, SD = 14.8 years; 70.7% female and 93.8% white) investigated physical activity (IPAQ-SF) in the early phase of the COVID-19 restrictions of each country in >18-year-olds. Younger people (18-29 years) reported

more negatives changes (decreasing exercise behavior 26.1%) than all other age groups (between 11.1% -19.1%, p = < .001) (Faulkner et al., 2021).

Finally, in a Greek study that examined how young adults (N = 1559,18 - 30 years) coped with COVID-19-related problems, 39.8% indicated that they used 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 management[1]

Nutrition and eating behavior

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).

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

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)

Sleep (and screen time)

A health relevant daily behavior is **sleep**. Studies indicate an increase in sleep time in children and youth. Pietrobelli et al. (2020) report increased sleep time (*M* = 0.65 hours/day, *SD* = 1.29, hours/day, *p* = 0.003). They also found that children's screen time increased (*M* = 4.85 hours/day; *SD* = 2.40 hours/day; *p* < 0.001), 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).

Further, in a study in four longitudinal age-homogeneous British cohorts during the first UK national lockdown (May 2020), 21.9% of the Millennium Cohort Study participants (MCS, 19 to 20 years) reported getting less sleep. Key workers[2] were at higher odds of sleeping less than other participants (OR 1.64, 95% CI; 1.11 – 2.38, p = .011) (Topriceanu et al., 2021). The cross-sectional study in south Italy (Pisano et al., 2021, see above) that collected data from a convenient sample of 326 adolescents during the strictest quarantine period from April 25th to May 13th 2020 using a web-based online survey observed that 40.5% reported that the quality of their sleep has been modified "very much", 37.7% " a little", and 21.8% " not at all".

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

An Italian online cross-sectional survey (Dondi et al., 2021) in families with children up to 18 years old investigating social determinants of health, mood changes, symptoms of anxiety, increase in sleep disorders and unusual repetitive movements. The focus of the paper was put on sleep changes: emergence or worsening of initiating sleep initiation, maintaining sleep, and nocturnal awakenings after the pandemic outbreak in children. In 4306 (69.3%) families, children had more difficulties falling asleep; the frequency of these episodes was more than twice a week in a third of the children (30.0%). In 1873 (30.2%) families, the children had more difficulties staying asleep; the

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

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 ($p = 0.066$) but no group differences were observed in girls.

Internet/Social media (and screen time)

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

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. 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. While the patient samples are often small, pre-pandemic data are available. 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.

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

Number of publications: 59

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

Results

Impact on body weight

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

Paulauskaite et al. (2021) nested a survey in an existing RCT trail 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 at al. (2020) studied the impact of coronavirus disease (COVID-19) on routine childhood vaccination in England. Measles-mumps-rubella vaccination (12 to 18-month-olds) counts dropped prior to physical distancing measure, but showed highest drop 3 weeks after physical distancing by 19.8% (95% CI; -20.7 – -18.9) and hexavalent vaccination (<6-month-olds) was 6.7% (95% CI; -7.1 – -6.2) compared to same period in 2019. Albeit containment measure continued, in week 16 and 17 counts were higher than 2019, indicating a rebound and improvement in mid-April.

Specific diseases

Significant ($p < .001$) reduction of **acute otitis media** episodes/month compared to pre-pandemic time period ($M = 0.07$, $SD = 0.35$ vs. $M = 0.37$, $SD = 0.64$, respectively), otorrhea episodes/month ($M = 0.01$, $SD = 0.09$ vs. $M = 0.48$, $SD = 0.80$, respectively) and the use of antibiotics ($M = 0.09$, $SD = 0.38$ vs. $M = 085$, $SD = 0.88$, respectively) was observed in a study in Italy by Toretta et al. (2020). Parents in this Italian study also reported improvement in 82.3% of the cases. Another study from Italy (Gelardi et al., 2020) yields reduced exposure to children due to closed day care and schools led to a clinical improvement in otalgia, otorrhea and hearing loss in children with **adenoid or tonsillar hypertrophy**, as rated by the parents ($N = 120$), leading to changes in therapy. Moreover, parents attributed a lower average symptom score of 4.1 as compared to a score of 6.7 on a 0-10-point Likert scale ($p < .0001$).

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

A number of studies exist on **diabetes** and diabetes management. In a study from Italy, Passanisi et al. (2020) found some benefits of lock-down measures regarding diabetes type 1 (T1D) management in 204 patients recently diagnosed with T1D: roughly a third of the patients reported more intensive daily glucose monitoring (33.8%) while 18.6% paid less attention to their glycemic levels, and 47.5% of patients did not report differences from the pre-quarantine period. Almost half of the patients (49%) did not need to contact the Diabetes team for advice on managing their disease. Children <12 years were significantly more influenced by the quarantine period in their approach to the disease than older patients ($p = .017$). Christoforidis et al. (2020) from Greece confirmed that glycemic control can be adequately achieved comparable to the pre-lockdown period in children with type 1 diabetes mellitus wearing an insulin pump equipped with a sensor ($N = 34$). They showed similar mean time in range (TIR) values.

In another study from Italy (Schiaffini et al., 2020), data from 22 school children that were equipped with a Tandem Basal IQ Technology providing real-time glycemic control data, indicated significantly ($p < .001$) higher median value of TIR (66.41% vs. pre-pandemic 61.45%) and a showed a lower time above range value (TAR) during in-pandemic period than pre-pandemic (29.86 ± 10.6% vs 34.73 ± 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 & Maffeis, 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/ m2and 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; ± 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 ($p = 0.002$, respectively $p = 0.001$) 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).

Most studies observed no differences between in-pandemic and pre-pandemic periods regarding the total insulin dose and the basal insulin delivery (Tornese et al., 2020; Schiaffini et al., 2020; Christofordis et al., 2020) while some found statistically significant difference ($p < .05$) in mean bolus doses and daily number of correction boluses (Schiaffini et al., 2020, Marigliano & Maffeis, 2021) and changes in meal schedules (Christoforidis et al., 2020).
With respect to newly diagnosed diabetes in children and adolescents, Rabbone et al. (2020) invited all Italian pediatric diabetic centers to participate in a survey study (79.9% participation).

They observed 23% fewer new diabetes cases compared with the same period in 2019, and children presenting with diabetic ketoacidosis (DKA) had more severe DKA (pH < 7.1) in 2020 than in 2019 (44.3% vs. 36%, respectively; *p* = .03); while DKA episodes and severe hypoglycemia were similar between the two periods. These data suggest a lower exposure to triggering factors, such as infections, but at the same time delayed diagnosis.

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

An Italian study (Di Riso et al., 2021) investigated asthma control and children's and mothers' psychological functioning in 45 **asthmatic children** aged 7 to 14 years (M_{Age} = 10.67; SD_{Age} = 2.29), compared to a healthy control sample matched for age and gender (*N* = 41; $Mean_{Age}$ = 11.02; SD_{Age} = 2.25). An online survey was conducted after the lockdown from May 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 = 0.023) and in April 2020 (*p* = 0.007) 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 = 0.011) as well as in April 2020 (p = 0.017) 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 umol/l, SD ± 252, vs. 556.4 umol/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 pasts 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.

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

Many countries experienced a change in utilization of health services, partly due to recommendations to postpone health care appointments, reorganizations of wards and departments to cope with COVID-19 patients with impact on pediatric care (Agostini et al., 2020) or closing of specific services altogether. Overall, most studies yield evidence that contacts for most medical conditions were lower than in comparative time periods (Mansfield et al., 2021). Some studies 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 suggest that patients avoided health services out of fear of infection and stay-at-home rules.

A study in the UK examined primary care contacts for almost all conditions using de-identified electronic health records from the Clinical Research Practice Datalink (CPRD) Aurum (2017 $N_{11\text{-}20}$ = 1'233'387,$N_{21\text{-}30}$ = 1'455'550; 2018 $N_{11\text{-}20}$ = 1'283'296, $N_{21\text{-}30}$ = 1'499'066; 2019; $N_{11\text{-}20}$ = 1'319'983, $N_{21\text{-}30}$ = 1'517'439; 2020 $N_{11\text{-}20}$ = 1'325'412, $N_{21\text{-}30}$ = 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).

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).

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

A Turkish cross-sectional study (Kahraman et al., 2021) evaluated the interruption of enzyme replacement therapy (ERT) in patients with lysosomal storage diseases and the clinical subjective consequences of this interruption. 75 patients of a Children's Hospital with a median age of 12 years filled out an online survey between July 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 (± 3) in Italy (Ferraro et al., 2021). Compared to 2019, in 2020 more children changed their maintenance therapy (14/92 [15.2%] vs. 35/92 [38%]; $p < .001$). There was a significant increase in both of children who increased (2019: 2/92 children [2.2%] vs. 2020: 10/92 children [10.9%]; $p = .033$) and children who reduced (2019: 12/92 [13%] vs. 2020: 25/92 children [27.2%]; $p = .026$); their maintenance therapy. As asthma control levels improved in the whole sample, also in children with severe asthma treated by Omalizumab, children and their parents seem to have managed the maintenance therapy well.

Impact on emergency department hospital visits

Emergency department visit decreases were observed in many hospitals. According to a study in Italy (Comelli et al., 2020), emergency department visits in the youngest age groups declined (0 – 12, 13 – 18) while visits by adults and older age groups increased. Agostini et al. (2020) (Italy) describe a significant decrease in admissions in the pediatric emergency unit after the beginning of the lockdown phase. The 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. Amon the 5820 ED visits in 2020 and the 23,241 in 2017–2019 were 50 intoxicated patients in 2020 and 124 in 2017–2019., A higher proportion of ED visits were due intoxication in 2020 (0.8% vs 0.5%, p=0.01) 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% vs. 66.5%, 95% CI; 62.4 – 70.4%) compared to 2019. Calls due to exposures increased (79.3%, 95% CI; 75.1 – 82.7% vs. 72.0%, 95% CI; 68.1 – 75.6%) while simple information requests decreased. Among all exposures referrals to the ED, the referral of pre-school children (≤ 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. Generally, children, adolescents and young adults miss their social contacts and peers and report increased feelings of loneliness, but adolescents and young adults seem to be affected even more. 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, and general psychopathology increased. Thereby, 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. Additional correlates of depression and increased clinical symptoms that have been found in other studies were worsened sleep quality and decreases in exercise behavior. Moreover, the quality of the diet correlated with perceived happiness and physical health, depending on school children's weight status. For young adults who were working, reduced working was associated with increased levels of distress, particularly for those employees who were self-isolating/sick, permanently laid-off or in caregiving roles. For professional athletes no differences to non-athletes were found regarding their depression, anxiety, and stress symptoms.

Regarding effects of COVID-19 related measures on newborn infants, a study pointed to increases in impaired mother-infant bonding during the pandemic. Thereby, parental tolerance for children's disobedience war 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. 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 effects. While some benefitted from the reduction of external demands that cause stress (e.g., tightly organized school schedules for children with ADHD or social situations for children with ASD), others experience decreases as external support is reduced (e.g., local health services, school or private therapist) and an aggravation of symptoms such as repetitive movements. 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. 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 mental health specific consultations decreased in January to February 2020 (ca. 5 to 15%) and increased again in March to June (ca. 5 to 20%) with about half of the consultations in March and May and all consultation in April being teleconsultations.

Number of publications: 53 (40 in May; 26 in April; 14 in March)
Time period: Jan 2020 to September 2021, single publications from March to June, 2021.

Results

Worries and social contacts

A study from Italy by Buzzi et al. (2020) observed that the majority of adolescents were moderately worried in general, but less worried that their parents. Adolescents in south-central regions in Italy, which were less affected, reported greater worries that in northern regions. Containment measured

were considered to be appropriate (> 90%), with 41 – 57% reporting that they adhered sometimes or always to the measurements. About 32 – 37% of the adolescents think there will be negative consequences in school education, whereby females worried more than men and 27% report that they don't know. The majority experienced changes in their social relationships with 70% indicating that they have more social network contacts but less physical meetings and 22% state that they have less of both, and 8% report no change. Worries and fears varied according to gender, age, and region.

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

The cross-sectional study by Pisano et al. (2021, see above) in south Italy examined factors related to emotional symptoms during the strictest quarantine period in a convenient sample of 326 adolescents. Analyses showed that, during the quarantine, adolescents were more worried about their families getting infected (M = 7.2, SD = 3.1) than they were worried about themselves (M = 4.3, SD = 3.6), $t(325) = 14.71$, $p < .001$. A hierarchical regression analysis revealed that general psychopathology symptoms (SDQ), $\beta = .556$, $p < .001$ and worries about infection (WI), $\beta = .110$, $p = .013$, were both uniquely independent predictors of anxiety, $r^2 = .425$, $p < .001$. No other significant effects were observed. That is, over and above the other variables in the model, the higher the general psychopathology symptoms before the COVID-19 and the worries about the infection, the higher the state anxiety during the quarantine was (Pisano et al., 2021).

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

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

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

The report "Atlas der Emotionen. Die neue Gefühlslandkarte der Schweiz" by Bosshardt et al. (2020) is based on the Swiss campaign "Wie geht es dir?" [“How are you?”] for the promotion of mental health, which is carried out by the cantons and Pro Mente Sana on behalf of Health Promotion Switzerland. Amongst others, the report shows which emotions and feelings have gained or lost importance 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.

Psychological distress and loneliness

The Swiss Corona Stress Study provided insights the distress of adolescents and young adults (Quervain et al., 2021). The last survey of the Swiss Corona Stress Study in November 2020 has shown that the proportion of respondents with moderately severe to severe depressive symptoms was 18%, with the youngest group of 14- to 24-year-olds being the most affected at 29%. Between March 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, 2.24 – 10.87; OR = 1.87, 1.28 – 2.73 respectively). Compared to January/February 2020, psychological distress in April 2020 was increased from 20.1% to 31.8% and reduced working was associated with greater psychological distress (OR = 1.30, 95% CI; 1.14 – 1.49). Females and those not living in a couple were also more likely to report psychological distress (OR = 2.09, 1.82 – 2.40 and OR = 1.70, 1.47-1.96 respectively). Older age (OR = 0.44, 0.33-0.59 for those aged 45 to 54 years) and higher baseline weekly household earnings (OR = 1.08, 1.01-1.17) appeared to be protective.

This Turkish study (Şenışık et al., 2021) aimed to explore whether the mental health status of professional athletes was affected by the isolation period, in which organized sports were

suspended due to the COVID-19 pandemic. A total of 571 participants between the ages of 18 and 38 (M = 24.53, SD = 5.09, n_{males} = 372, $n_{females}$ = 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 – to 15.3) to 20.2% (95% CI; 16.0 – 25.2) during lockdown.

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

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

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

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

In the UK; Cooper et al. (2021) used data from the Covid-19: Supporting Parents, Adolescents and Children during Epidemics (Co-SPACE) study to explore the association between loneliness, social relationships, and mental health in adolescents. Self-reported data from 894 young people (age 11 to 16) were used. The data was collected at tow 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. A total of 1316 adolescents answered the 2-year follow-up survey before (unexposed to COVID-19 pandemic, controls) and 584 after 1 February 2020 (COVID19-exposed). Adolescents reported higher levels of stress (baseline vs control: $M = 15.1$, $SD = 5.9$ / $M = 16.7$, $SD = 6.4$, $p < .001$; baseline vs COVID19-exposed: $M = 15.8$, $SD = 6.3$ / $M = 17.1$, $SD = 6.3$, $p < .001$) and psychosomatic symptoms (baseline vs control: $M = 11.2$, $SD = 5.4$ / $M = 11.8$, $SD =$

6.0, $p < .001$; baseline vs COVID19-exposed: $M = 12.0$, $SD = 5.7$ / $M = 12.1$, $SD = 6.2$, $p = .674$) and lower levels of happiness (baseline vs control: $M = 30.5$, $SD = 6.3$ / $M = 28.2$, $SD = 6.9$, $p < .001$; baseline vs COVID19-exposed: $M = 29.6$, $SD = 7.1$ / $M = 27.2$, $SD = 7.5$, $p < .001$) at follow-up compared to baseline. The COVID-19-exposed group showed no deterioration in peer relations (control $M = 15.9$, $SD = 3.4$; COVID19-exposed $M = 15.8$, $SD = 3.5$, $p = .794$) or relations with parents (control $M = 20.3$, $SD = 3.9$; COVID19-exposed $M = 20.3$, $SD = 3.8$, $p = .667$) versus controls.

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-Camblor, 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 (β = 0.57, 95% CI 0.53 to 0.60) and worsened mental wellbeing (β = –0.46, 95% CI –0.49 to –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 (β = 4.16, 95% CI 4.05 to 4.28, and β = –1.13, 95% CI –1.23 to –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 (χ^2 (1) = 12.20, p < .001) and being concerned about their appearance (χ^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).

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 to 2.66) and alcohol intoxication (OR 2.59, 95% CI 2.56 to 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 to 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)

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 $N_{11\text{-}20}$ = 1'233'387,$N_{21\text{-}30}$ = 1'455'550; 2018 $N_{11\text{-}20}$ = 1'283'296, $N_{21\text{-}30}$ = 1'499'066; 2019; $N_{11\text{-}20}$ = 1'319'983, $N_{21\text{-}30}$ = 1'517'439; 2020 $N_{11\text{-}20}$ = 1'325'412, $N_{21\text{-}30}$ = 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% confidence interval [CI] 0.41–2.02). This acceleration was primarily for urgent or emergency referrals (acceleration 0.96, CI 0.39–1.54), including referrals to liaison psychiatry (0.68, CI 0.35–1.02) and mental health crisis teams (0.61, 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).

Autism Spectrum Disorder: Well-being and social contact

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

Also, a study from Spain (Mumbardó-Adam et al., 2021) observed that some children with ASD were more irritable because of the unpredictability of the situation. However, in their study, the majority of the responding families with a child with ASD highlighted that their children were happier than before quarantine. "Families observed that their children were more communicative, participated more often in family routines, and in choice-making decisions regarding family activities. The majority seemed to be comfortable with the situation and did not often asked to go back to school or to previous routines. Families also benefited from this extra time with their sons and daughters to teach new skills related to their autonomy, to house care routines, and perhaps more importantly, to social skills and communicative interaction. The external support seems to play an important role for the experiences of children with ASD and their families. In the study by Mumbardó-Adam et al., families appreciated to have school and online psychological support, and truly valued their cohesion and online contact with relatives during quarantine. However, they also claimed for social comprehension regarding their children special needs during quarantine (such as going out for a walk), more flexibility at their workplaces to better conciliate with their family life, and they would also have appreciated a more continued educational support, and a more tailored monitorization of school activities (Mumbardó-Adam et al. 2021).

Similarly, Colizzi et al. (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 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 (≥ 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

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 remined stable of the course of the 8 weeks. 23 to 33 % of patients showed an improvement over the course

of the weeks, albeit the majority a minor improvement, and 22 to 30% showed a deterioration, again mostly minor deterioration of their mental health status (Lavenne-Collot et al., 2021).

Children with cancer diagnoses

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

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.

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

Number of publications: 7 (3 in May)

Time period: Jan 2020 to September 2021, single publications from March to June 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 [$\chi 2$ (2, N = 171) = 28.8, p < .001, V = .41]. Individuals under the age of 21 years reported more support (79.4%) than did adults (38.7%). Educational support was mostly provided by relatives (n = 81, 82.7%), while little support was provided by organizations (n = 9, 9.4%) or school communities (n = 4, 4.8%). Being supported by a third party to complete the survey was consistently related to perceptions of worse outcomes.

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

Scarpellini et al. (2021) explored the experiences in organizing school for children at home and its implications on children’s psychological well-being. A cross-sectional, observational study using an online questionnaire was conducted from May 8th to 15th, 2020. It targeted mothers of children aged 6 to 15 years old (N = 1601). The children’s attitude towards distance learning varied between primary and middle school students: 28.3% of the primary school students could not pay attention for more than 20 minutes (OR = 2.39, 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 (Δr = .64). Comparing changes over time, language skills showed the most significant overall effect (Δr = .72), characterized by strong effects in expressing language skills (Δr = .67), phoneme analysis (Δr = .58), and a medium effect in phoneme-grapheme correspondence (Δr = .47). Only language comprehension ability did not change significantly over time (Δr = .03). With respect to mathematical thinking, a medium effect between pre- and post-data collection was observed (Δr = .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.

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, initial studies indicate 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: 29 (24 in May; 19 in April)

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

COVID-19-relevant professionals / Key workers

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

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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