

**VILNIUS UNIVERSITY
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The Final thesis

Impact of the COVID-19 Pandemic on Adolescent Mental Health

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ABSTRACT

Background: The COVID-19 pandemic is known to have various effects on adolescent's mental health. This thesis is composed of a systemic review and an online survey assessing the impact of the COVID-19 pandemic on adolescent's mental health.

Methods: For the qualitative systemic review, online databases (PubMed, Scopus, GoogleScholar) were searched until February 3, 2023. The impact of homeschooling and COVID-19 pandemic on mental health, leisure time, school and family life has been assessed. The online survey was conducted with an anonymous questionnaire among students aged 15 to 20 years in Germany from 12. January 2023 to 21. March 2023. The questionnaire consisted of seven sections: 1. general questions, 2. school-related changes in student's well-being, 3. health-related changes in student's well-being, 4. restriction-related changes in student's well-being and 5. leisure- and communication-related habits. These categories had to be answered as "changed", "unchanged" or "worsened". The question if participants are afraid of getting infected with COVID-19 had to be answered as "I am not afraid", "I am neither fearless, nor afraid", "I am afraid", "I am very afraid", "I do not know". Four open-ended questions about strengths and weaknesses of home-schooling and school life since students returned to school after lockdown were included at the end of the questionnaire.

Results: Adolescents reported a decrease in well-being, more depressive symptoms, and increased stress levels during homeschooling. Stress was shown to be associated with social isolation, distraction during work and loss of concentration and motivation as most prevalent during the period of remote studies. After remote studies have ended, stress levels remained high but were associated with the perceived pressure to fill the educational gap which has been created by the COVID-19 pandemic. In Germany, internet problems, technical obstacles and impeded contact to teachers were described as most disturbing during home-schooling. The systemic review and the online survey agree that females report decreased mood, physical exercise and appetite more frequently compared to males. Moreover, fear of getting infected with COVID-19 was high during the period of remote studies but decreased after returning to school. Three years after the pandemic started, hygienic measures and COVID-19-related restrictions were reported as affecting well-being of German adolescents negatively. Positive aspects perceived during online studies were longer sleep in the morning, more leisure time, and the ability to gain more autonomy in the organization of learning and structuring daily life.

Conclusion: The systematic review highlighted the deterioration of mental and physical well-being in adolescents during remote studies. The online survey drew the attention to the still existing changes in adolescent's wellbeing three years after the pandemic has started. Further research is needed to follow-

up adolescents' health to detect long-term consequences of the pandemic on their physical and mental health to open the possibility to intervene tackle mental health problems in adolescents.

Keywords: COVID-19 pandemic, adolescent, mental health, distance learning, school reopening, home-schooling

INTRODUCTION

The COVID-19 pandemic had its origin in late December 2019 in Wuhan, China. As the SARS-CoV-2 virus spread worldwide, governments implemented various measures to flatten the curve of new infections. Among these measures, social distancing, quarantines, lockdowns, school closures, face masks and various other measures were taken to prevent the spread of the disease. Since the beginning of the pandemic until today, psychiatric implications of COVID-19 and COVID-19-related impacts on mental health have been reported in literature.

Adolescents represent a special group of population. During adolescence, various biological and psychosocial developmental stages are experienced which provide the basic framework for the maturity of the psychosocial development. Moreover, personality disorders and other psychological diseases are known to have its origin in adolescence.

Many studies have been published with the aim to report changes in mental health during the COVID-19 pandemic. Besides, little is known of the extend of the COVID-19 pandemic on the mental health of adolescents, a group of society which had to cope with school closures, social distancing and at the time was inevitably exposed to online schooling, changing daily routines and other challenges in life. This thesis is composed of a systemic review and an online survey for adolescents aged 15 to 20 years in Germany. The systemic review aims to provide a qualitative systematic review with the research question "What is the impact of homeschooling and COVID-19 pandemic on mental health, leisure time, school and family life in adolescents?". The online survey was originally performed from October to December 2021 in Lithuania by Prof. dr. Sigita Lesinskienė. (1) For the cope of this master thesis, the questionnaire was translated into German and carried out from 12. January 2023 to 21. March 2023.

LITERATURE SEARCH STRATEGY

The search strategy of the systemic review was based on keywords and included free-full-text articles of the databases PubMed, Scopus and GoogleScholar published in English and German until 03. February 2023.

The titles and abstracts were screened, and the full-text articles were reviewed meeting the following criteria: [1] homeschooling, remote studies, online learning, remote learning, distant learning, Onlineunterricht; [2] COVID-19, Covid-19 Pandemic, SARS-Covid-2, SARS-Cov-2, Coronapandemie, Covid pandemic, Corona-Pandemie; [3] adolescents, adolescent. The protocol on this systematic review is based on PRISMA guidelines and is illustrated in Fig. 1.

194 citations were retrieved from biomedical databases and published until 03. February 2023, of which 101 were found on PubMed, 15 on Scopus and 78 on GoogleScholar. 86 citations were excluded due to duplications and 108 citations were assessed for full-text reading. 58 records were excluded due to mismatch of inclusion and exclusion criteria. Studies were included if [1] it includes adolescents, aged 10-24 years or if age was not specified, school grades were given representing the corresponding age span; [2] it was considered investigated interventions; [3] language is German or English and; [4] it was published until 03.02.2023. Also, no country restriction, race, or gender restrictions.

Studies were excluded if [1] the full text was unavailable or only abstract was assessable; [2] studies were unrelated to the research question; [3] language was other than German or English; [4] they were published in books; [5] age or grade was not specified; [6] it included third person perceptions rather than direct answers from adolescents; [7] the study was ongoing, and no results have been published yet and [8] participants were diagnosed with a psychological disease before pandemic has started.

In total 50 articles were included in the systematic review.

Data extraction was performed by creating summary tables from the included studies described in detail in the section results.

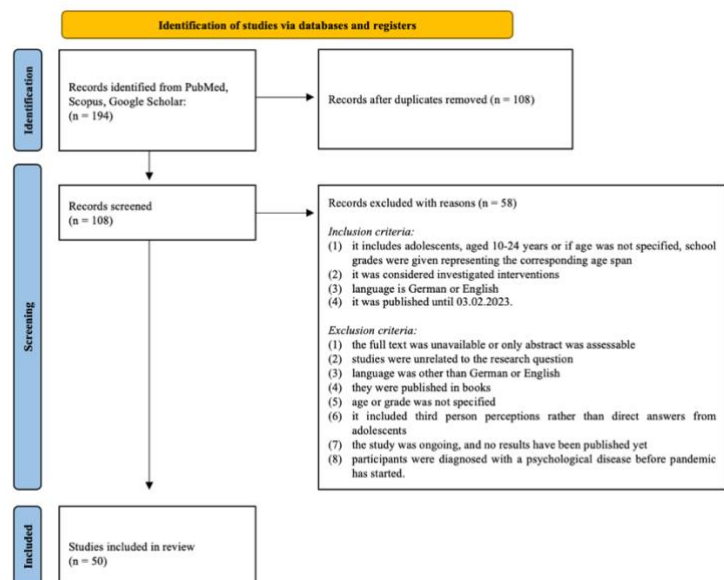


Figure 1: PRISMA search protocol of the systematic review

RESULTS OF THE SYSTEMATIC REVIEW

The results of the systemic review are described in table 1 and table 2 of the appendix.

Table 1 shows the list of resources grouped in database ID, authors, and title of the publication. Table 2 categorizes authors, year of publication, country, study design, patient characteristics, the research question/questions, and the results of the study.

Of the 50 included studies, eleven studies have been carried out in China (n=1.278.930), five studies in United States (n=1762), four in Italy (n=2146), three studies in Austria (n=5750), Germany (n=464) and Australia (n=711), two studies in Switzerland (n=4338 where control sample is excluded), Poland (n=2519 where control sample is excluded) and worldwide (n=42.798 including one systematic review) and one study in United Kingdom (n=1387), Belgium (n=16.093), Russia (n=120), California (n=372), Netherlands (n= 462), Brazil (n=259), United Arab Emirates (n=1720), Indonesia (n=166), Hungary (n=2508), Canada (n=2310), Portugal (n=617), Hong Kong (n=938), Israel (n=1019) and Georgia (n=761). One study included the countries Luxembourg, Germany, and Brazil (n=1613). In total this systematic review analyzes impacts on mental health of 1.369.763 adolescents aged 10 to 24 years.

Most research questions in the included studies focused on mental health, depressive symptoms, anxiety of the future and COVID-19, stress, loneliness, sleep, concentration and distraction, motivation, physical activity, screen media activities, risk and protective factors for increased stress and mental health problems. Common variables were age, gender, wealth, education, and emotional competence before the start of the pandemic.

Worsening of mental health and well-being was reported in nine studies (2,3,4,5,6,7,8,9,10), whereas depressive symptoms were mentioned as predominant manifestation. Eleven studies (4,8,9,11,12,13,14,15,16,17,18) highlighted the increased feeling of anxiety during COVID-19 pandemic. Predominantly, the feeling of anxiety connected to personal health and getting ill during the pandemic and anxiety of future were mentioned.

One important aspect during COVID-19 pandemic was stress, especially related to remote studies. Six studies (13,14,16,19,20,21) identified a significant increase in stress level in adolescents during pandemic. Two studies (11,22) reported loss of concentration and motivation and four articles (2,7,11,13) highlighted that student felt more distracted in their education during the pandemic compared to pre-pandemic times. At the same time, three studies (11,13,19) noted that adolescents reported an increase in the amount of homework during pandemic. Rzanova et al. showed that that school performance did not deteriorate besides the above-mentioned aspects in half of the students.

(11)

Research identified risk and protective factors for stress and mental health problems during COVID-19 pandemic. Four studies (8,10,16,23) named family stress as a risk factor for mental health inquiries in times of pandemic and two studies (21,24,25) reported not exercising as being associated with increased levels of stress. Other risk factors mentioned were overcrowding, financial difficulties, domestic violence, inequality in homeschooling, emotion-based coping, distant learning, poor academic performance, previous mental health disorders, insomnia, living urban and not living with parents (4,15,18, 19,23,25,26,27,28).

Protective factors were having no material deprivation, having support, peer contact, recreational activities, attitudes and abilities, online learning satisfaction, emotional regulation, less feeling isolated, cyberbullying perpetration, computer access, relatives participated in COVID-19 related work, school connectedness, greater involvement in lessons in the past year, positive mindset, carrying out pleasurable activities, connecting with family and friends, establishing routines, leisure activities, cognitive-emotional regulation, self-efficacy in online learning, reduction of leisure-time digital activities, having support in distance learning, having self-regulated learning strategies, physical activity and good parent-child relationship, whereas the most commonly mentioned protective factor was having social support described in three studies (8,19,29,30,31,32,33,34,36,37,38,39,40).

Focusing on risk groups, data show that adolescents living in impoverished conditions, adolescents of older age and females turned out as the vulnerable groups for mental health problems during COVID-19 pandemic. Adolescents living in impoverished conditions with missing resources were reported as a risk group in two studies (6,17,26). Collier et al. named living in low or moderate education families as a risk factor for increased stress perception (41). Also, five studies showed that increased age was associated with a higher prevalence of mental health deterioration in adolescents (19,23,25,27,42), whereas one study found the opposite that younger adolescents reported higher stress levels during pandemic (16). In total, 12 studies highlighted that stress and mental health problems are seen more frequently in adolescent girls rather than boys (4,9,14,16,18,19,20,24,25,26,28,43). Especially feeling lonely was reported more frequently in females.

The decrease in physical activity was reported by three studies (3,24,44) and three studies (4,15,27) found sleep problems as a risk factor for mental health deterioration. Three studies (45,46,47) came to the result that sleep during remote studies was described as “improved” compared to pre-pandemic. These studies showed that sleep was delayed but longer and students woke up later compared to pre-pandemic times.

Six studies (4,8,44,48,49,50) found an increase in screen-time during pandemic and Liu et al. identified problematic internet use to be positively associated with depression and insomnia, especially in middle and late adolescence. (27) Moreover, Bani-Issa et al. found that adolescents with increased screen

times experience poor sleep quality in terms of sleep latency and disturbances. (49) Guazzini et. al noted a change in the use of technologies and found out that relationship increased during pandemic despite social isolation whereas wellbeing decreased. (43) They proposed the hypothesis that smartphones were “necessary for connecting” and allowed a better connection with friends during social isolation and distancing. Moreover, German studies focused on cyberbullying and cybervictimization during pandemic. Pfetsch et al. noticed the positive connection of cyberbullying and well-being, especially for students with a high need to belong. (34) Thus, they formulated the hypothesis that cyberbullying may serve as a way for connectedness during pandemic and regulate the feeling of loneliness maladaptively during social isolation. To highlight the opposite perspective, Schunk et. al showed that cybervictims present with beliefs of lower self-efficacy and engage in rumination which can be seen as a maladaptive strategy for emotional regulation. (31)

Moreover, research was guided towards the question how pre-pandemic conditions affected well-being of adolescents during COVID-19 pandemic. Waters et al. highlighted that positive education prior to pandemic served as a protective factor for stress-related growth during COVID-19 pandemic and after returning to school. (30) In addition, Pelikan et al. compared students who perceived themselves as having high competence with those who described themselves as having low competence. (40) They found that higher motivation, less procrastination, better coping, and less supportive needs were seen in students with high self-regulated learning abilities, despite both, students with high and low competences, reported similar challenges during pandemic. Also, online learning readiness and emotional competence affected academic performance positively during pandemic. (33)

Furthermore, studies pointed to the impact of the COVID-19 pandemic and homeschooling when returning to school. Lan et al. identified self-efficacy during remote learning as being “a key factor influencing perceived worries of adolescents after school resumed” (32). Tzankova et al. highlighted that online schooling opened the door to a new way of flexible learning and autonomy in the organization of learning. (50)

METHODS OF THE ONLINE SURVEY

Design of the study

The survey was designed in an anonymous online questionnaire. The questionnaire has originally been developed by Prof. dr. Lesinskienė et al. and was published in the paper “A study of students (I–IV gymnasium classes) well-being changes during school reopening after COVID-19 pandemic” (1). For the purpose of this master thesis the Lithuanian questionnaire was translated into German.

Questions of personal data like gender, study year, age, and school type were included. The questionnaire contained questions on wellbeing in school after distant learning (communication with classmates, communication with teachers, grades, concentration during lessons, general well-being at school), questions regarding personal health (sleep, appetite, mood, study capacity, physical activity, vision), questions on wellbeing at school in the context of COVID-19 related restrictions (face mask, distance, movement restrictions, adjustments of schedules, food intake restrictions, social restrictions) and questions related to leisure habits (communication with family members, communication with friends, interest in leisure activities, time management). Each question was rated “improved”, “worsened” or “unchanged”. In addition, one question was given to evaluate the fear of COVID-19 by choosing one of the five possible answers “I am not afraid”, “I am neither fearless, nor afraid”, “I am afraid”, “I am very afraid”, “I do not know”. Also, four questions were open-ended asking for strengths and weaknesses of homeschooling and school life since students returned to school after lockdown.

Participants were recruited by addressing schools, sport clubs, leisure organizations, driving schools and social media via distribution of the weblink.

Data Analysis

Descriptive statistics included number of participants, age (mean±SD), gender (female, male, divers), study year and school type. Questions about school-related changes in student’s well-being, health-related changes in student’s well-being, restriction-related changes in student’s well-being leisure- and communication-related habits and fear of infection with COVID-19 were calculated for each outcome (improved, worsened, unchanged) in absolute values and percentages and calculated for different gender groups (female, male) and age groups (15,16,17,18,19,20). The gender group “divers” was excluded in the gender-dependent calculation since the amount (n=1) of participants of this gender category is statistically not representable. Level of significance was calculated with Chi-square tests using Microsoft Excel.

There were no calculations with school type and years of studies with the above-described categories since Germany presents a special school system with multiple types of education and a non-linear order and labeling of study years in each school design.

Open-ended questions were summarized using thematic analysis by categorizing answers into codes. Common codes were identified, and numbers of appearance were counted. Qualitative analysis was performed using Microsoft Excel.

RESULTS OF THE ONLINE SURVEY

Sample demographics

A total of 241 responses were collected and the descriptive data can be retrieved from Figure 2. Age ranged from 15 to 20 years (mean 17.02, SD 1.52). 64% were female, 35% were male and less than 1% was divers. Students mostly were enrolled in the school type “Gymnasium” (63,07%), which is the highest level of education school in Germany. 19,09% are enrolled in “Berufsbildende Schule” which provides education for apprenticeships. Less than 10% were enrolled in “Realschule” which represents the medium education level school in Germany. Other school types “Oberschule”, “Gesamtschule” und “Hauptschule” were computed less than 5% each. 4,15% of students go to schools not mentioned in these categories. Most participants (30.71%) were in study year 11. 20.75% were in year 10, 18,26% were in year 12, 9,54% in year 13, 5% were in year 9 and 15,77% were in years not included in the answers above. Those students who chose “other” in this category can be explained by because the school type of “Berufsbildende Schule” was included in the study and this type of education has a different structure of study years compared to general education models.

Participants	total	n = 241
Age (years), Mean±SD		17,02±1,52
Gender, n (%)	female	155 (64,32)
	male	85 (35,27)
	divers	1 (0,45)
School type, n (%)	Gymnasium	152 (63,07)
	Berufsbildende Schule	46 (19,09)
	Realschule	18 (7,47)
	Andere	10 (4,15)
	Gesamtschule	7 (2,90)
	Oberschule	5 (2,07)
	Hauptschule	3 (1,24)
study year, n (%)	9	12 (5,00)
	10	50 (20,75)
	11	74 (30,71)
	12	44 (18,26)
	13	23 (9,54)
	other	38 (15,77)

Figure 2: Descriptive statistics of the online survey

School-related changes in student's well-being

In this section students were asked to report changes in school after remote learning.

Most students (54%) reported that communication with classmates has not changed after home-schooling. Descriptive statistics indicate that there is a tendency that communication with classmates worsened with increasing age. However, further analysis is necessary to determine exact correlation between age and the effect on communication after COVID-19-related homeschooling.

Communication with teachers was reported as being unchanged by 50% of participants, improved by 30% and worsened by 20%.

Grades were seen to be unchanged in 39% of students, worse in 37% and improved in 24%. The changes of grades after home-schooling in different age groups are illustrated in Figure 3. Student's reports about changes in grades after home-schooling were shown to be slightly different depending on age ($\chi^2=16.52$, $p=0.08$). Descriptive statistics point to the hypothesis that the interval

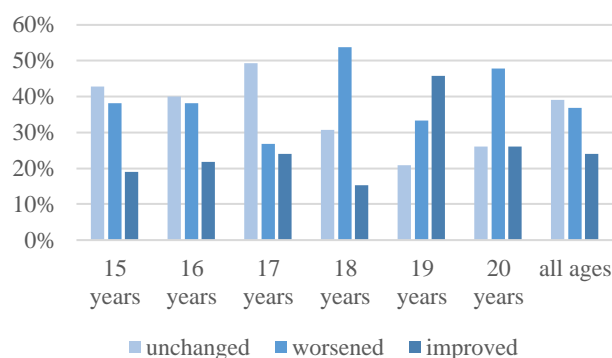


Figure 3: Changes in grades after home-schooling

between changes in grades increases with age, meaning that the educational gap increases with age. Further analysis is necessary to examine the correlation between age and changes in grades after home-schooling.

Concentration during classes after remote studies is described as worse by 52% of students and 38% do not see a change in their concentration.

General well-being at school before and after remote studies was reported as unchanged by 55% of students and worsened in 31%. Here, neither age nor age must be found to influence general well-being at school.

Health-related changes in student's well-being

In this part students were asked about the changes after home-schooling in different health categories. Sleep was reported to be worse by 44% of students and did not change in 37%. The effect of home-schooling has had a different effect on sleep depending on gender ($\chi^2=11.69$, $p=0.003$) and age ($\chi^2=24.19$, $p=0.007$) and these differences are statistically significant. Descriptive statistics indicate that sleep was worse in female students (51%) compared to male students (31%). Male students more frequently reported no change in sleep during home-schooling. Descriptive statistics show that sleep

is reported as “improved” more frequently with increasing age. These measures need further investigations for correlations.

Appetite during remote studies did not change in 60% of individuals, worsened in 24% and improved in 16%. Changes in appetite during remote studies were seen to vary to a different extent in males and females ($\chi^2=15.25$, $p=0.0005$) and these differences are statistically significant. Despite most females and males reported no change in appetite, descriptive statistics indicate that female students tend to report a worsening in appetite whereas male students are shown to improve in appetite. These findings are illustrated in Figure 4.

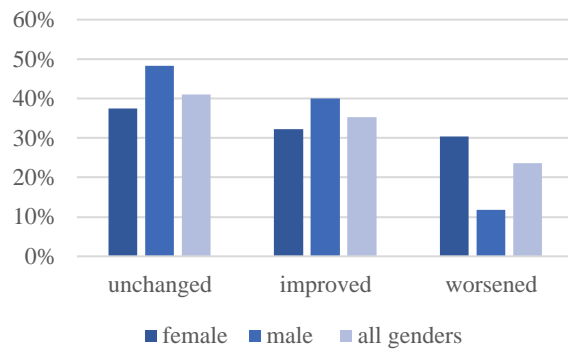


Figure 4: Changes in appetite after home-schooling

Mood during remote studies was reported as worse in 43% of students, unchanged in 38% and improved in 19%. Gender ($\chi^2=7.45$, $p=0.02$) is seen to influence the effect of homeschooling on mood during pandemic. Descriptive statistics provide the assumption that mood worsened in females to a greater extent compared to males, whereas males tend to report improved mood more frequently than females. The changes in mood after home-schooling in respect to gender are illustrated in Figure 5. Descriptive statistics indicate that mood is the worst in 18-year-old students and improves in older and younger individuals. These hypotheses on mood need to be further evaluated.

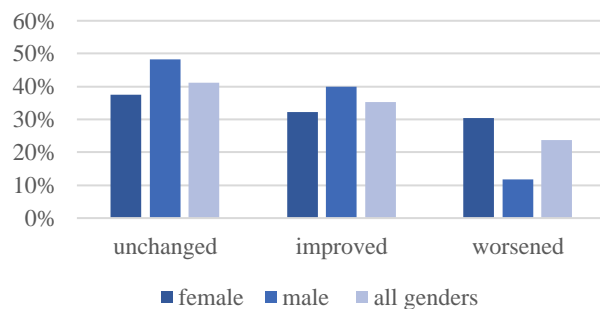


Figure 5: Changes in mood after home-schooling

Learning capacity is reported as worsened in 51% of participants, unchanged in 33% and improved in 16%. Data shows that the effect of homeschooling on learning capacity has had a slightly different effect on students depending on age ($\chi^2=17.89$, $p=0.06$). Descriptive statistics indicate that the percentage of students who reported no change in learning capacity is relatively constant among different ages, whereas the gap between students with worsening and improving learning capacity is the greatest among 18-year-old students and decreases if age decreases and increases. These findings may correlate with changes in mood and needs no be further evaluated.

Physical activity was reported to be worse (34%), unchanged (34%) and improved (33%) to almost the same extent in students during remote studies. Changes in physical activity were shown to be different in males and females and these differences are statistically significant ($\chi^2=12.41$, $p=0.002$).

Descriptive data show that females report a decrease in physical activity during homeschooling, whereas males reported an increase in physical activity. These correlations need to be further evaluated. These findings are shown in Figure 6.

Vision was reported as unchanged during remote studies and neither gender, nor age are seen to affect vision.

Confidence was reported to be unchanged in 49% of participants, improved in 27% and worsened in 25%. The smallest variance between levels of confidence was reported by students aged 18 years. This needs to be further analyzed.

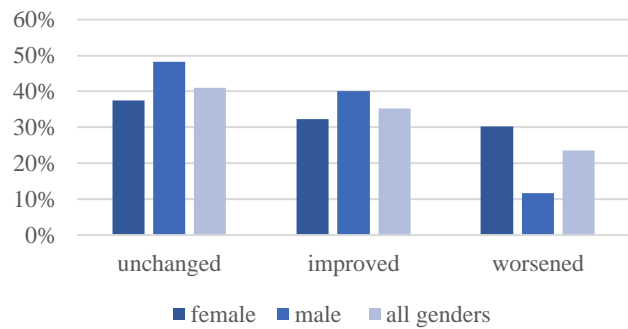


Figure 6: Changes in physical activity after home-schooling

Restriction-related changes in student's well-being

Here, students were asked how their well-being at school changed after COVID-19 pandemic in terms of COVID-19 related restrictions.

Wearing a face mask at school worsened the well-being of students in 40%, whereas 39% do not describe a change in wellbeing and 22% report improved well-being.

Keeping distance is recorded as worsening wellbeing at school in 47% of participants. 39% of students report no change in well-being by keeping distance and 14% report an increase of well-being.

Movement restrictions at school were reported as having no influence on well-being by 45% of participants. 44% of participants associate movement restriction with a decrease in well-being and 10% report an increase of well-being related to movement restrictions.

Adjustment of schedules have been reported as not influencing wellbeing by 58% of students, whereas 27% describe schedule changes as a factor for decrease in well-being and 15% of students associate adjustments of schedules with improved wellbeing. The effect of changes in schedules on adolescents varies with different ages and these changes are statistically significant ($\chi^2=18.07$, $p=0,05$).

Food intake restrictions does not influence well-being in 60% of students, whereas 34% reported a decrease in well-being and 5% of adolescents link food intake restrictions with improved well-being.

Social restrictions worsened the well-being of 58% of students, 33% reported no change in well-being and 10% showed an improved well-being. The effect of social restrictions on well-being slightly differs depending on age ($\chi^2=16.68$, $p=0,08$).

Leisure- and communication-related habits

In this section students were asked how leisure- and communication-related habits at home changed when returning to school after remote learning.

Communication with family members has been described as unchanged by 63% of participants, improved by 20% and worsened by 17%. Changes of communication with family members tend to be most prominent in 19-years-old students according to descriptive statistic.

Communication with friends was described as unchanged by 47% of participants, improved by 36% and worsened by 17%.

Interest in leisure activities was marked as being unchanged after remote learning by 41%, improved by 35% and worsened by 24%. The effect of returning to school on interest in leisure activities was different in females and males ($\chi^2=10.46$, $p=0,005$) and slightly different at different ages ($\chi^2=16.06$, $p=0,098$). Descriptive statistics underline that female students report to have lost interest in leisure activities more often compared to male participants. Also, students at younger age report improvement in interest in leisure activities more frequently than older students. Changes of interest in leisure activities dependent on gender and age is illustrated in Figure 7 and Figure 8.

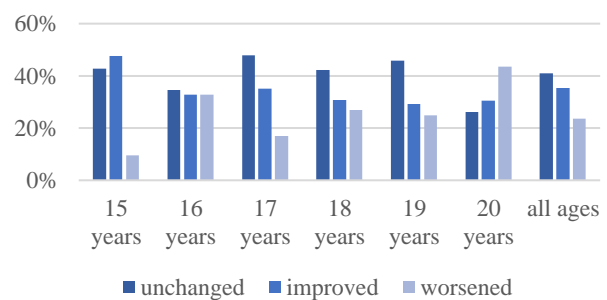
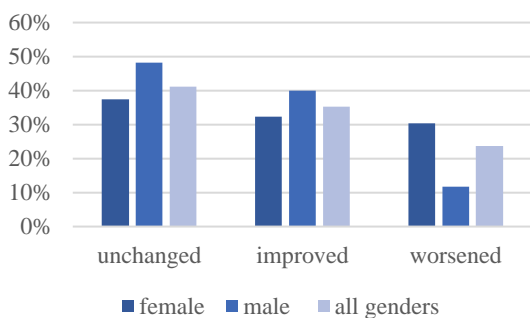


Figure 7: Changes in interest in leisure activities (gender-related) Figure 8: Changes in interest in leisure activities (age-related)

Time management was reported as unchanged after remote schooling in 40% of students, worsened in 32% and improved in 28%.

Fear of infection with COVID

Most students (65%) reported that they are not worried about getting infected with COVID-19 at school. 29% described their attitude as neither being afraid, nor being worried. Only 3% of participants expressed the fear to get infected with COVID-19 at school.

Strengths and weaknesses of home-schooling

The most frequently reported negative aspect of home-schooling was the lack of social interaction. Students described that they miss to meet their classmates and feel lonely. Also, adolescents mentioned that they do not like online classes. Reasons were the absence of group work, no direct contact, less opportunities to ask questions, unstructured classes, spending too much time in front of the computer, decreased quality of education and overload of teachers. The most frequently named reasons for aversion to remote studies were technical and internet problems of students and teachers.

Furthermore, 32 adolescents mentioned that the load of homework was too heavy, explanations of teachers were insufficient, and they felt overstrained. 14 adolescents described the absent personal communication with teachers and the lack of feedback as negative during remote studies.

Also, 13 students highlighted that they lost structure of daily life and described their days as monotonous. Seven students made the statement that they are unmotivated and lack discipline and six students felt distracted at home.

On the other side, there were students who experienced being at home as positive during home-schooling. 15 adolescents described that their life during remote studies was less stressful, five participants stated that they enjoyed spending more time with their family and 20 students noticed the advantage to have more free time.

The most prominent positive aspects of home-schooling were individual time management, the increase in self-determination and the longer duration of sleep in the morning.

Also, the “Szenario B”, which was developed in Germany and compromise the separation of one school class into two groups to allow weekly changes of life- and remote-schooling, was reported as positive.

Strengths and weaknesses of school life since students returned to school after lockdown

An increase in stress when students returned to school was reported by 37 participants. Most often, the increase in stress was described together with the keyword “increasing pressure”. 18 adolescents highlighted the increased educational gap between classmates. Also, students felt that remote studies lead to a gap in education because students felt less educated during home-schooling. After returning to school, they had the impression that teachers aim to fill this gap which leads to overload of students. Moreover, 13 students expressed that school in presence offers less self-determination and is associated with less free time. In total, 15 students felt distracted by COVID-19-related restrictions. Wearing face masks, room ventilation by opening the windows and keeping distance were reported as affecting their well-being negatively. In this context, adolescents highlighted the huge spectrum of

opinions on COVID-19-restrictions. Also, students noticed that some classmates changed in behavior and were described as “easily irritable” after the period of home-schooling.

The most frequently named negative aspect when returning to school was the earlier waking up compared to home-schooling.

When school was reintroduced in the contact way, adolescents enjoyed social contacts and face-to-face communication. They described the level of education as improved because the way study contents were imparted improved. Also, they had the impression to have a better learning outcome and asking questions is eased in the contact way.

As a positive impact of the pandemic, students concluded that home-schooling offered a new digital way of education, which has been incorporated into school life after pandemic.

DISCUSSION

The discussion aims to formulate the main findings of the systematic review and the online survey, relate them and guide to possible explanations and correlations.

The systematic review highlighted the loss of concentration, distraction during work, increased workload, and loss of motivation in adolescents during home-schooling. In addition, Rzanova et al. found that grades did not deteriorate despite the above-mentioned impacts. (2) The online survey supports these finding. Students outlined that internet problems and technical obstacles influenced the quality of online school in Germany negatively. It is unclear if technical problems and low quality of internet connection has an impact in countries other than Germany. Moreover, the survey underlines that the communication with teachers decreased which was one of the major aspects for dissatisfaction during home-schooling. Adolescents reported a decrease in concentration and learning capacity when returning to school after remote studies. Lithuanian students reported a decrease in learning results when returning to school after home-schooling. (1) The German survey identifies school performance as unchanged in most participants, but nearly the same number of students indicated a decrease in grades. Descriptive statistics point to the hypothesis that the educational gap in adolescents increased with age after remote studies have ended. When students were asked in the German survey to report negative aspects after home-schooling, many adolescents expressed their impression that they feel an increase in the educational gap between classmates. Furthermore, they have the feeling that remote studies go along with a gap of imparted study content which had to be caught up since returning to school. One may have assumed that the high stress levels during home-schooling decrease after returning to school because factors as social isolation, motivational loss, distraction at home and other negative aspects cease after school is conducted in the contact way. The online study points to the

hypothesis that stress after online classes is related to different aspects compared to home-schooling-related stress. After remote studies, students felt stressed and “pressured” by filling up the educational gap home-schooling has created and since then, try to catch up the educational level they would have had if COVID-pandemic has not influenced their adolescence. In the future, research needs to further evaluate if an educational gap exists, and if this gap narrows with increasing post-pandemic interval. In addition, the systemic review included variables such as overcrowding, financial difficulties, domestic violence, inequality in homeschooling, living urban and not living with parents, which were declared as risk factors for stress and mental health deterioration. These variables were not considered in the online survey but nevertheless may affect education.

Sleep was found to be improved during the period of home-schooling. Studies found out that sleep was delayed but longer and students woke up later during home-schooling compared to pre-pandemic. The online survey underlines these findings in Germany and Lithuania. (1) Students described their sleep as worse after returning to school. In addition, the advantage of later waking up in the morning was mentioned frequently as positive during home-schooling and furthermore early waking up is considered as a negative aspect of school in the contact way. Here, the earlier waking up during school in presence is probably associated with the time students needs for their way to school.

The systematic review showed that physical activity was found to be decreased during homeschooling. The online survey indicated that effects of homeschooling on physical activity differs among adolescents. Females were indicated to exercise less and males increased their exercise level after home-schooling. Thus, one can hypothesize that the decreased physical activity during home-schooling lead to an increase in physical activity in males and worsened in females after remote studies have ended. Moreover, despite most adolescents reported appetite as “unchanged”, the study analysis found females to be more likely to develop a decrease in appetite and males reported an increase in appetite more frequently than females. The Lithuanian survey supports the finding that physical activity and appetite decreased in girls when returning to school. (1) One possible explanation could be that females, who are physically more inactive have less appetite and males who increased their physical activity have an increase in appetite.

One of the most described results of the systematic review was that mood during home-school decreased and the decrease in mood is significantly pronounced in females compared to males. The online survey showed that mood after home-schooling has been over did not change in most participants, but females were more likely to suffer a decrease in mood than males. The Lithuanian results of the online survey showed a pronounced decrease of well-being at school, concentration, communication with classmates, vision, self-confidence, physical activity, learning efficiency, mood and appetite in adolescent girls compared to adolescent boys. (1) Taking these findings together, one

may hypothesize that females suffer decreased mood which resulted in being less physically active and thus, present with a decrease in appetite due to a decrease in basal metabolic rate and due to decrease in wellbeing. Further investigations are needed to detect a protentional correlation between mood, physical activity, and appetite.

Restriction-related changes such as wearing face masks, keeping distance and social distancing are seen to have a negative effect on adolescent's wellbeing. In addition, almost all participants of the online survey reported that they are not afraid to get infected with COVID-19 at school or are neither afraid nor worried. The systemic review found that during remote studies adolescents were afraid of getting infected with COVID-19 which correlated with their well-being. These findings point to the hypothesis that three years after the pandemic started, restrictions may harm adolescent's well-being to a greater extent than the fear of getting infected with COVID-19. Moreover, participants of the online study expressed their impression of a large range of opinions on protective measures for COVID-19 at school and that the variety of opinions created a basis for discussions between classmates.

Leisure- and communication-related habits such as interest in leisure activities, communication with friends and family members turned out as being unchanged for most participants when remote studies ended. These factors were identified by the systemic review as protective factors for stress and mental health problems during home-schooling. Further analysis is needed to detect if these factors remain unchanged or improve with increasing post-pandemic interval. Students rated the increased time for leisure activities during remote studies as positive in the online study and criticized the decrease in free time after school has been reintroduced in contact way.

Some students mentioned the "Szenario B" in the online survey and evaluated this way of education as positive. The "Szenario B" was introduced in Germany after the lockdown in the first phase when returning to school in presence. Here, each class was split into half and the first group were educated in remote way during the first week and in the face-to-face way during the second week and vice versa. This regulation enables students to implement the positive aspects of home-schooling and education in presence and decrease the downsides of both ways of education. Thus, one can assume that sleep quality, concentration and mental health will improve in the mixed way and social isolation, disruption at home and motivation loss play a minor role. Moreover, students are enabled to have greater liberties and larger scopes to structure their daily life which and was reported as positive during home-schooling and was missed when returning to school in presence. Moreover, students save more time for their free time when they do not need to spend time on their way to school.

All in all, the systematic review and the online survey highlighted that problems which appeared during home-schooling does not necessarily persist after remote studies ended. Nevertheless, the COVID-

pandemic including lockdowns and the period of home-schooling created the base for the development of new issues when returning to school in the contact way.

LIMITATIONS

First, the systematic review included international studies which analyzed a wide spectrum of adolescent's mental health. Nevertheless, due to different country-specific COVID-19 restrictions, these results are not comparable. Moreover, the online survey was conducted in Germany where different burdens appeared during the period of homeschooling compared to other nations. Therefore, the online survey needs to be seen to highlight aspects in Germany and results cannot be transferred to other countries. Also, many studies were composed of questionnaires in a large spectrum of different languages which shows language bias.

Another point is that the size of participants of the online survey is not high enough to present valid results. In the future studies, a larger sample size should be used to validate the results of the online survey. Moreover, the online questionnaire was not mandatory to be answered and there was no kind of compensation offered. Thus, "volunteer bias" cannot be excluded. Moreover, the Lithuanian online survey (x) found age as an influencing factor for COVID-19-related impacts on mental health. These findings were not reproducible in Germany since the sample size and the variance in age did not provide the basis for significant conclusions on age as an influencing factor for COVID-19 related changed when returning to school

In terms of the questionnaire itself, students were asked to express their answer in three categories "improved", "unchanged" and "worsened" instead of a Likert-scale. Therefore, it was not possible to correlate the results properly. Since most participants indicated "Gymnasium" as their school type, the possibility to correlate school type with queried categories was not useful since the sample size of other school types was too small. Also, the online questionnaire does not include several factors which were explored and have been relevant in other studies such as smartphone use, protective and risk factors for mental health, the living conditions of adolescents and wealth of the family. Additionally, the age for inclusion in the study was 15 to 20 years, which does not represent the whole range of adolescents. The age of 15 was set as the lower margin, because from this age German law allows minors to fill in questionnaires without the approval of parents.

All in all, one basic limitation of the online questionnaire and many studies included in the systematic review is the absence of a psychosocial baseline in adolescents before the COVID-19 pandemic has begun.

CONCLUSIONS AND RECOMMENDATIONS

To conclude the findings of the systematic review and the online survey, a high number of studies aimed to investigate adolescent's mental and physical health, as well as school performance, potential risks, and protective factors for adolescents during the COVID-19 pandemic and the period of home-schooling. Authors agreed that factors such as decrease in mood, loss of social interactions, increase in symptoms of anxiety and depression, are of worrying character. Only a few studies pay attention to the question how the pandemic impact adolescents' daily life three years after the intense lockdown period has ended. In the future, further investigations are needed to follow-up adolescent's mental and physical wellbeing since this generation has been exposed to a physically and emotionally intense period which has already been identified as affecting mental health.

This online survey highlights that the pandemic and home-schooling still have a negative impact on well-being of adolescents and that research is still indispensable to prevent long-term consequences for adolescents today and adults of tomorrow.

APPENDIX

Table 1: Included studies for systematic review

Database ID	Author	Title of the publication	Reference
57204740450	De Coninck, D., Matthijs, K., Van Lancker, W.	"Distance Learning and School-Related Stress Among Belgian Adolescents During the COVID-19 Pandemic"	De Coninck D, Matthijs K, Van Lancker W. Distance Learning and School-Related Stress Among Belgian Adolescents During the COVID-19 Pandemic. <i>Front Educ</i> 2022;7.
57553520500	Rzanova, S., Vobolevich, A., Dmitrichenkova, S., Dolzhich, E., Mamedova, L.	"Distance learning challenges and prospects during Covid-19 in the context of adolescent education"	Rzanova S, Vobolevich A, Dmitrichenkova S, Dolzhich E, Mamedova L. Distance learning challenges and prospects during Covid-19 in the context of adolescent education. <i>Soc Work Ment Health</i> 2022;20(6):716-734.
57220096357	Kwaning, K., Ullah, A., Biely, C., Jackson, N., Dosanjh, K.K., Galvez, A., Arellano, G., Dudovitz, R.	"Adolescent Feelings on COVID-19 Distance Learning Support: Associations With Mental Health, Social-Emotional Health, Substance Use, and Delinquency"	Kwaning K, Ullah A, Biely C, Jackson N, Dosanjh KK, Galvez A, et al. Adolescent Feelings on COVID-19 Distance Learning Support: Associations With Mental Health, Social-Emotional Health, Substance Use, and Delinquency. <i>J Adolesc Health</i> 2023.
34273194	Stone JE, Phillips AJK, Chachos E, Hand AJ, Lu S, Carskadon MA, Klerman EB, Lockley SW, Wiley JF, Bei B, Rajaratnam SMW	"In-person vs home schooling during the COVID-19 pandemic: Differences in sleep, circadian timing, and mood in early adolescence"	Stone JE, Phillips AJK, Chachos E, Hand AJ, Lu S, Carskadon MA, Klerman EB, Lockley SW, Wiley JF, Bei B, Rajaratnam SMW; CLASS Study Team. In-person vs home schooling during the COVID-19 pandemic: Differences in sleep, circadian timing, and mood in early adolescence. <i>J Pineal Res.</i> 2021 Sep;71(2):e12757. doi: 10.1111/jpi.12757. Epub 2021 Aug 3. PMID: 34273194; PMCID: PMC8420593.
36330117	Li F. (15)	"Impact of COVID-19 on the lives and mental health of children and adolescents"	Li F. Impact of COVID-19 on the lives and mental health of children and adolescents. <i>Front Public Health.</i> 2022 Oct 18;10:925213. doi: 10.3389/fpubh.2022.925213. PMID: 36330117; PMCID: PMC9623428.
34665762	She R, Wong K, Lin J, Leung K, Zhang Y, Yang X	"How COVID-19 stress related to schooling and online learning affects adolescent depression and Internet gaming disorder: Testing Conservation of Resources theory with sex difference"	She R, Wong K, Lin J, Leung K, Zhang Y, Yang X. How COVID-19 stress related to schooling and online learning affects adolescent depression and Internet gaming disorder: Testing Conservation of Resources theory with sex difference. <i>J Behav Addict.</i> 2021 Oct 19;10(4):953–66. doi: 10.1556/2006.2021.00069. Epub ahead of print. PMID: 34665762; PMCID: PMC8987435.
35885859	Jesser A, Schaffler Y, Gächter A, Dale R, Humer E, Pieh C.	"School Students' Concerns and Support after One Year of COVID-19 in Austria: A Qualitative Study Using Content Analysis"	Jesser A, Schaffler Y, Gächter A, Dale R, Humer E, Pieh C. School Students' Concerns and Support after One Year of COVID-19 in Austria: A Qualitative Study Using Content Analysis. <i>Healthcare (Basel).</i> 2022 Jul 18;10(7):1334. doi: 10.3390/healthcare10071334. PMID: 35885859; PMCID: PMC9315779.

34078968	Green KH, van de Groep S, Sweijen SW, Becht AI, Buijzen M, de Leeuw RNH, Remmerswaal D, van der Zanden R, Engels RCME, Crone EA	"Mood and emotional reactivity of adolescents during the COVID-19 pandemic: short-term and long-term effects and the impact of social and socioeconomic stressors"	Green KH, van de Groep S, Sweijen SW, Becht AI, Buijzen M, de Leeuw RNH, Remmerswaal D, van der Zanden R, Engels RCME, Crone EA. Mood and emotional reactivity of adolescents during the COVID-19 pandemic: short-term and long-term effects and the impact of social and socioeconomic stressors. <i>Sci Rep.</i> 2021 Jun 2;11(1):11563. doi: 10.1038/s41598-021-90851-x. PMID: 34078968; PMCID: PMC8172919.
32959611	Kang S, Sun Y, Zhang X, Sun F, Wang B, Zhu W.	"Is Physical Activity Associated with Mental Health among Chinese Adolescents during Isolation in COVID-19 Pandemic?"	Kang S, Sun Y, Zhang X, Sun F, Wang B, Zhu W. Is Physical Activity Associated with Mental Health among Chinese Adolescents during Isolation in COVID-19 Pandemic? <i>J Epidemiol Glob Health.</i> 2021 Mar;11(1):26-33. doi: 10.2991/jegh.k.200908.001. Epub 2020 Sep 11. PMID: 32959611; PMCID: PMC7958283.
34563065	Commodari E, La Rosa VL.	"Adolescents and Distance Learning during the First Wave of the COVID-19 Pandemic in Italy: What Impact on Students' Well-Being and Learning Processes and What Future Prospects?"	Commodari E, La Rosa VL. Adolescents and Distance Learning during the First Wave of the COVID-19 Pandemic in Italy: What Impact on Students' Well-Being and Learning Processes and What Future Prospects? <i>Eur J Investig Health Psychol Educ.</i> 2021 Jul 9;11(3):726-735. doi: 10.3390/ejihpe11030052. PMID: 34563065; PMCID: PMC8314351.
33859580	Li X, Tang X, Wu H, Sun P, Wang M, Li L.	"COVID-19-Related Stressors and Chinese Adolescents' Adjustment: The Moderating Role of Coping and Online Learning Satisfaction"	Li X, Tang X, Wu H, Sun P, Wang M, Li L. COVID-19-Related Stressors and Chinese Adolescents' Adjustment: The Moderating Role of Coping and Online Learning Satisfaction. <i>Front Psychiatry.</i> 2021 Mar 30;12:633523. doi: 10.3389/fpsy.2021.633523. PMID: 33859580; PMCID: PMC8042164.
34093323	Waters L, Allen KA, Arslan G.	"Stress-Related Growth in Adolescents Returning to School After COVID-19 School Closure"	Waters L, Allen KA, Arslan G. Stress-Related Growth in Adolescents Returning to School After COVID-19 School Closure. <i>Front Psychol.</i> 2021 May 20;12:643443. doi: 10.3389/fpsyg.2021.643443. PMID: 34093323; PMCID: PMC8174561.
35082725	Pfetsch JS, Schultze-Krumbholz A, Lietz K.	"Can Acting Out Online Improve Adolescents' Well-Being During Contact Restrictions? A First Insight Into the Dysfunctional Role of Cyberbullying and the Need to Belong in Well-Being During COVID-19 Pandemic-Related Contact Restrictions"	Pfetsch JS, Schultze-Krumbholz A, Lietz K. Can Acting Out Online Improve Adolescents' Well-Being During Contact Restrictions? A First Insight Into the Dysfunctional Role of Cyberbullying and the Need to Belong in Well-Being During COVID-19 Pandemic-Related Contact Restrictions. <i>Front Psychol.</i> 2022 Jan 10;12:787449. doi: 10.3389/fpsyg.2021.787449. PMID: 35082725; PMCID: PMC8784371.
36352002	Metherell TE, Ghai S, McCormick EM, Ford TJ, Orben A.	"Digital access constraints predict worse mental health among adolescents during COVID-19"	Metherell TE, Ghai S, McCormick EM, Ford TJ, Orben A. Digital access constraints predict worse mental health among adolescents during COVID-19. <i>Sci Rep.</i> 2022 Nov 9;12(1):19088. doi: 10.1038/s41598-022-23899-y. PMID: 36352002; PMCID: PMC9645341.

35877298	Guazzini A, Pesce A, Gino F, Duradoni M.	"How the COVID-19 Pandemic Changed Adolescents' Use of Technologies, Sense of Community, and Loneliness: A Retrospective Perception Analysis"	Guazzini A, Pesce A, Gino F, Duradoni M. How the COVID-19 Pandemic Changed Adolescents' Use of Technologies, Sense of Community, and Loneliness: A Retrospective Perception Analysis. Behav Sci (Basel). 2022 Jul 13;12(7):228. doi: 10.3390/bs12070228. PMID: 35877298; PMCID: PMC9311528.
34608352	Schunk F, Zeh F, Trommsdorff G.	"Cybervictimization and well-being among adolescents during the COVID-19 pandemic: The mediating roles of emotional self-efficacy and emotion regulation"	Schunk F, Zeh F, Trommsdorff G. Cybervictimization and well-being among adolescents during the COVID-19 pandemic: The mediating roles of emotional self-efficacy and emotion regulation. Comput Human Behav. 2022 Jan;126:107035. doi: 10.1016/j.chb.2021.107035. Epub 2021 Sep 30. PMID: 34608352; PMCID: PMC8481162.
35959029	Kostorz K, Zwierzchowska A, Ziemba M	"Effects of the COVID-19 Pandemic on the Perception of Inclusion in School Education and Physical Activity Among Polish Students"	Kostorz K, Zwierzchowska A, Ziemba M. Effects of the COVID-19 Pandemic on the Perception of Inclusion in School Education and Physical Activity Among Polish Students. Front Psychol. 2022 Jul 26;13:880791. doi: 10.3389/fpsyg.2022.880791. PMID: 35959029; PMCID: PMC9361868.
36465307	Marciano L, Viswanath K, Morese R, Camerini AL.	"Screen time and adolescents' mental health before and after the COVID-19 lockdown in Switzerland: A natural experiment"	Marciano L, Viswanath K, Morese R, Camerini AL. Screen time and adolescents' mental health before and after the COVID-19 lockdown in Switzerland: A natural experiment. Front Psychiatry. 2022 Nov 16;13:981881. doi: 10.3389/fpsyg.2022.981881. PMID: 36465307; PMCID: PMC9709147.
35273750	Santos JS, Louzada FM.	"Changes in adolescents' sleep during COVID-19 outbreak reveal the inadequacy of early morning school schedules"	Santos JS, Louzada FM. Changes in adolescents' sleep during COVID-19 outbreak reveal the inadequacy of early morning school schedules. Sleep Sci. 2022 Jan-Mar;15(Spec 1):74-79. doi: 10.5935/1984-0063.20200127. PMID: 35273750; PMCID: PMC8889976.
32723373	Zhou J, Yuan X, Qi H, Liu R, Li Y, Huang H, Chen X, Wang G.	"Prevalence of depression and its correlative factors among female adolescents in China during the coronavirus disease 2019 outbreak"	Zhou J, Yuan X, Qi H, Liu R, Li Y, Huang H, Chen X, Wang G. Prevalence of depression and its correlative factors among female adolescents in China during the coronavirus disease 2019 outbreak. Global Health. 2020 Jul 28;16(1):69. doi: 10.1186/s12992-020-00601-3. PMID: 32723373; PMCID: PMC7385712.
33036622	Chen S, Cheng Z, Wu J.	"Risk factors for adolescents' mental health during the COVID-19 pandemic: a comparison between Wuhan and other urban areas in China"	Chen S, Cheng Z, Wu J. Risk factors for adolescents' mental health during the COVID-19 pandemic: a comparison between Wuhan and other urban areas in China. Global Health. 2020 Oct 9;16(1):96. doi: 10.1186/s12992-020-00627-7. PMID: 33036622; PMCID: PMC7545801.
33823875	Wang J, Wang H, Lin H, Richards M, Yang S, Liang H, Chen X, Fu C.	"Study problems and depressive symptoms in adolescents during the COVID-19 outbreak: poor parent-child relationship as a vulnerability"	Wang J, Wang H, Lin H, Richards M, Yang S, Liang H, Chen X, Fu C. Study problems and depressive symptoms in adolescents during the COVID-19 outbreak: poor parent-child relationship as a vulnerability. Global Health. 2021 Apr 6;17(1):40. doi: 10.1186/s12992-021-00693-5. PMID: 33823875; PMCID: PMC8022312.

35312701	Musa S, Elyamani R, Dergaa I.	"COVID-19 and screen-based sedentary behaviour: Systematic review of digital screen time and metabolic syndrome in adolescents"	Musa S, Elyamani R, Dergaa I. COVID-19 and screen-based sedentary behaviour: Systematic review of digital screen time and metabolic syndrome in adolescents. PLoS One. 2022 Mar 21;17(3):e0265560. doi: 10.1371/journal.pone.0265560. PMID: 35312701; PMCID: PMC8936454.
34639788	Rahiem MDH, Krauss SE, Ersing R.	"Perceived Consequences of Extended Social Isolation on Mental Well-Being: Narratives from Indonesian University Students during the COVID-19 Pandemic"	Rahiem MDH, Krauss SE, Ersing R. Perceived Consequences of Extended Social Isolation on Mental Well-Being: Narratives from Indonesian University Students during the COVID-19 Pandemic. Int J Environ Res Public Health. 2021 Oct 6;18(19):10489. doi: 10.3390/ijerph181910489. PMID: 34639788; PMCID: PMC8508155.
34948634	Katona ZB, Takács J, Kerner L, Alföldi Z, Soós I, Gyömörei T, Podstawski R, Ihász F.	"Physical Activity and Screen Time among Hungarian High School Students during the COVID-19 Pandemic Caused Distance Education Period"	Katona ZB, Takács J, Kerner L, Alföldi Z, Soós I, Gyömörei T, Podstawski R, Ihász F. Physical Activity and Screen Time among Hungarian High School Students during the COVID-19 Pandemic Caused Distance Education Period. Int J Environ Res Public Health. 2021 Dec 10;18(24):13024. doi: 10.3390/ijerph182413024. PMID: 34948634; PMCID: PMC8701288.
35572851	Poulain T, Meigen C, Kiess W, Vogel M.	"Wellbeing, coping with homeschooling, and leisure behavior at different COVID-19-related lockdowns: A longitudinal study in 9- to 16-year-old German children"	Poulain T, Meigen C, Kiess W, Vogel M. Wellbeing, coping with homeschooling, and leisure behavior at different COVID-19-related lockdowns: A longitudinal study in 9- to 16-year-old German children. JCPP Adv. 2022 Mar;2(1):e12062. doi: 10.1002/jcv2.12062. Epub 2022 Feb 11. PMID: 35572851; PMCID: PMC9088342.
36137952	Maiorani C, Fernandez I, Tummino V, Verdi D, Gallina E, Pagani M.	"Adolescence and COVID-19: Traumatic Stress and Social Distancing in the Italian Epicenter of Pandemic"	Maiorani C, Fernandez I, Tummino V, Verdi D, Gallina E, Pagani M. Adolescence and COVID-19: Traumatic Stress and Social Distancing in the Italian Epicenter of Pandemic. J Integr Neurosci. 2022 Aug 15;21(5):143. doi: 10.31083/j.jin2105143. PMID: 36137952.
33686344	Pelikan ER, Lüftenegger M, Holzer J, Korlat S, Spiel C, Schober B	"Learning during COVID-19: the role of self-regulated learning, motivation, and procrastination for perceived competence"	Pelikan ER, Lüftenegger M, Holzer J, Korlat S, Spiel C, Schober B. Learning during COVID-19: the role of self-regulated learning, motivation, and procrastination for perceived competence. Z Erziehungswiss. 2021;24(2):393-418. doi: 10.1007/s11618-021-01002-x. Epub 2021 Mar 4. PMID: 33686344; PMCID: PMC7931168.
34149300	Cockerham D, Lin L, Ndolo S, Schwartz M.	"Voices of the students: Adolescent well-being and social interactions during the emergent shift to online learning environments"	Cockerham D, Lin L, Ndolo S, Schwartz M. Voices of the students: Adolescent well-being and social interactions during the emergent shift to online learning environments. Educ Inf Technol (Dordr). 2021;26(6):7523-7541. doi: 10.1007/s10639-021-10601-4. Epub 2021 Jun 14. PMID: 34149300; PMCID: PMC8202218.
33775081	Korzycka M, Bójko M, Radiukiewicz K, Dzielska A, Nałęcz H, Kleszczewska D,	"Demographic analysis of difficulties related to remote education in Poland from the perspective of adolescents during the COVID-19 pandemic"	Korzycka M, Bójko M, Radiukiewicz K, Dzielska A, Nałęcz H, Kleszczewska D, Małkowska-Szcutnik A, Fijałkowska A. Demographic analysis of difficulties related to remote education in Poland from the perspective of adolescents during the COVID-19

	Małkowska-Szkutnik A, Fijałkowska A.		pandemic. <i>Ann Agric Environ Med.</i> 2021 Mar 18;28(1):149-157. doi: 10.26444/aaem/133100. Epub 2021 Mar 5. PMID: 33775081.
33592433	Liu Y, Yue S, Hu X, Zhu J, Wu Z, Wang J, Wu Y.	"Associations between feelings/behaviors during COVID-19 pandemic lockdown and depression/anxiety after lockdown in a sample of Chinese children and adolescents"	Liu Y, Yue S, Hu X, Zhu J, Wu Z, Wang J, Wu Y. Associations between feelings/behaviors during COVID-19 pandemic lockdown and depression/anxiety after lockdown in a sample of Chinese children and adolescents. <i>J Affect Disord.</i> 2021 Apr 1;284:98-103. doi: 10.1016/j.jad.2021.02.001. Epub 2021 Feb 5. PMID: 33592433; PMCID: PMC8771471.
35439467	Liu S, Zou S, Zhang D, Wang X, Wu X.	"Problematic Internet use and academic engagement during the COVID-19 lockdown: The indirect effects of depression, anxiety, and insomnia in early, middle, and late adolescence"	Liu S, Zou S, Zhang D, Wang X, Wu X. Problematic Internet use and academic engagement during the COVID-19 lockdown: The indirect effects of depression, anxiety, and insomnia in early, middle, and late adolescence. <i>J Affect Disord.</i> 2022 Jul 15;309:9-18. doi: 10.1016/j.jad.2022.04.043. Epub 2022 Apr 16. PMID: 35439467; PMCID: PMC9013175.
34132922	Pieh C, Dale R, Plener PL, Humer E, Probst T.	"Stress levels in high-school students after a semester of home-schooling"	Pieh C, Dale R, Plener PL, Humer E, Probst T. Stress levels in high-school students after a semester of home-schooling. <i>Eur Child Adolesc Psychiatry.</i> 2022 Nov;31(11):1847-1849. doi: 10.1007/s00787-021-01826-2. Epub 2021 Jun 16. PMID: 34132922; PMCID: PMC8206876.
35670277	Bani-Issa W, Radwan H, Saqan R, Hijazi H, Fakhry R, Alameddine M, Naja F, Ibrahim A, Lin N, Naing YT, Awad M.	"Association between quality of sleep and screen time during the COVID-19 outbreak among adolescents in the United Arab Emirates"	Bani-Issa W, Radwan H, Saqan R, Hijazi H, Fakhry R, Alameddine M, Naja F, Ibrahim A, Lin N, Naing YT, Awad M. Association between quality of sleep and screen time during the COVID-19 outbreak among adolescents in the United Arab Emirates. <i>J Sleep Res.</i> 2023 Feb;32(1):e13666. doi: 10.1111/jsr.13666. Epub 2022 Jun 7. PMID: 35670277; PMCID: PMC9348184.
34040284	Schwartz KD, Exner-Cortens D, McMorris CA, Makarenko E, Arnold P, Van Bavel M, Williams S, Canfield R	"COVID-19 and Student Well-Being: Stress and Mental Health during Return-to-School"	Schwartz KD, Exner-Cortens D, McMorris CA, Makarenko E, Arnold P, Van Bavel M, Williams S, Canfield R. COVID-19 and Student Well-Being: Stress and Mental Health during Return-to-School. <i>Can J Sch Psychol.</i> 2021 Jun;36(2):166-185. doi: 10.1177/08295735211001653. Epub 2021 Mar 18. PMID: 34040284; PMCID: PMC8114331.
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33108542	Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J.	"Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 Pandemic"	Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J. Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 Pandemic. J Youth Adolesc. 2021 Jan;50(1):44-57. doi: 10.1007/s10964-020-01332-9. Epub 2020 Oct 27. PMID: 33108542; PMCID: PMC7590912.
34092475	Engel de Abreu PMJ, Neumann S, Wealer C, Abreu N, Coutinho Macedo E, Kirsch C.	"Subjective Well-Being of Adolescents in Luxembourg, Germany, and Brazil During the COVID-19 Pandemic"	Engel de Abreu PMJ, Neumann S, Wealer C, Abreu N, Coutinho Macedo E, Kirsch C. Subjective Well-Being of Adolescents in Luxembourg, Germany, and Brazil During the COVID-19 Pandemic. J Adolesc Health. 2021 Aug;69(2):211-218. doi: 10.1016/j.jadohealth.2021.04.028. Epub 2021 Jun 3. PMID: 34092475; PMCID: PMC8460548.
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33997969	Campbell K, Weingart R, Ashta J, Cronin T, Gazmararian J.	"COVID-19 Knowledge and Behavior Change among High School Students in Semi-Rural Georgia"	Campbell K, Weingart R, Ashta J, Cronin T, Gazmararian J. COVID-19 Knowledge and Behavior Change among High School Students in Semi-Rural Georgia. J Sch Health. 2021 Jul;91(7):526-534. doi: 10.1111/josh.13029. Epub 2021 May 16. PMID: 33997969; PMCID: PMC8207023.
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35103039	Peng X, Liang S, Liu L, Cai C, Chen J, Huang A, Wang X, Zhao J.	"Prevalence and associated factors of depression, anxiety and suicidality among Chinese high school E-learning students during the COVID-19 lockdown"	Peng X, Liang S, Liu L, Cai C, Chen J, Huang A, Wang X, Zhao J. Prevalence and associated factors of depression, anxiety and suicidality among Chinese high school E-learning students during the COVID-19 lockdown. Curr Psychol. 2022 Jan 27:1-12. doi: 10.1007/s12144-021-02512-x. Epub ahead of print. PMID: 35103039; PMCID: PMC8791692.
35039738	Wang Y, Xia M, Guo W, Xu F, Zhao Y.	"Academic performance under COVID-19: The role of online learning readiness and emotional competence"	Wang Y, Xia M, Guo W, Xu F, Zhao Y. Academic performance under COVID-19: The role of online learning readiness and emotional competence. Curr Psychol. 2022 Jan 13:1-14. doi: 10.1007/s12144-022-02699-7. Epub ahead of print. PMID: 35039738; PMCID: PMC8755984.

Table 2: Data extraction

Author, publication year	Country	Study design	Patient characteristics	Research question/s	Results
De Coninck, D., Matthijs, K., Van Lancker, W. (2022)	Belgium (05/2020)	- online survey including adolescents enrolled in secondary education in Flanders, Belgium in May 2020 - n=16093	- age: 12-18 years	- How do levels of self-reported stress differ between adolescents based on key sociodemographic characteristics like age, gender, and educational type? - To which extent are (online) learning environment-, family-, and peer-related factors associated with increased stress?	- Risk factors for increased stress: overcrowding, financial difficulties, and domestic violence. - Protective factors: social support and no material deprivation, peer contact. - Increased stress due to homework in homeschooling. - Older pupils experience more stress than younger age groups. - Girls experienced more stress (girls-58%, boys 49%)
Rzanova, S., Vobolevich, A., Dmitrichenkova, S., Dolzhich, E., Mamedova, L. (2022)	Russia (04/2022-05/2020)	- online survey for secondary high school general education students, teachers, and parents of these schoolchildren in the city of Neryungi in Russia - n=x whereas n=120 adolescents These findings for adolescents are extracted selectively from the article according to the research question of this systematic review.	- age: 13-17 years	What are the challenges and prospects of distance education for adolescents during COVID-19 pandemic?	- The volume of homework increased compared to pre-pandemic, therefore adolescents reported to have little time for themselves. - The ability to concentrate was negatively affected. - Anxiety about school performance increased and students were worried about their learning gap. - Half of the students reported that their performance did not deteriorate. - More than half of the students could not study at their comfortable place and most students felt more distracted.
Kwaning, K., Ullah, A., Biely, C., Jackson, N., Dosanjh, K.K., Galvez, A., Arellano, G., Dudovitz, R. (2023)	California (06/2020-06/2021))	- longitudinal survey in five large public high schools in a large urban district in Southern California - n=372	- grade: 9 (corresponds to age 14-15 years)	What are the associations among perceived distance learning school support, mental health, social-emotional wellbeing, substance use, and delinquency among low-income, public high school students?	- Support in distance learning was associated with better mental health outcomes, increased grit and self-efficacy and decreased stress.

<p>Stone JE, Phillips AJK, Chachos E, Hand AJ, Lu S, Carskadon MA, Klerman EB, Lockley SW, Wiley JF, Bei B, Rajaratnam SMW (2021)</p>	<p>Australia (11/2019-08/2020)</p>	<p>- data collected as part of an existing longitudinal cohort study trial in Australia in students of the first year of secondary schooling (year 7) in Melbourne, Australia - n=59</p>	<p>- age: 12.8 years (SD=0.4)</p>	<p>Was the COVID-19 induced change in school mode (in-person vs remote learning) associated with changes in sleep, circadian timing, and mood in early adolescents aged 12-13 years?</p>	<p>- Sleep is later and longer during remote learning compared to in-person learning by 22 minutes. During remote learning students went to sleep 26 minutes later and woke up 49 minutes later. - During remote learning students woke at a later circadian phase. - During remote learning lower anxiety symptoms and less daytime sleepiness were reported compared to in-person learning.</p>
<p>Li F. (2022)</p>	<p>Worldwide (05/2020-06.2020)</p>	<p>- online questionnaire basend on and extended on European Students' Union Survey - n=1111</p>	<p>- age not further specified These findings are extracted selectively from the article according to the research question of this systematic review.</p>	<p>What is the impact of COVID-19 on the lives and mental health of children and adolescents? - How have students around the world been satisfied with different aspects and elements of student life during the COVID-19 pandemic and how have they perceived them? - Are there any socio-demographic and geographic differences in 1. Students' satisfaction with and perception of selected elements of academic work and academic life due to the transition from onsite to online lectures. 2. Students' perception of the COVID-19 pandemic's consequences on their social and emotional life, personal circumstances, and habits. 3. Students' satisfaction with the role of selected institutions and their measures during the COVID-19 pandemic?</p>	<p>- Students require greater self-discipline and motivation to complete online classes. - The pandemic adversely affects student mental health, leading to an increased prevalence of Major Depressive Disorder (MDD) and Generalized Anxiety Disorder (GAD). These findings are extracted selectively from the article according to the research question of this systematic review.</p>

She R, Wong K, Lin J, Leung K, Zhang Y, Yang X (2021)	China (09/2020 - 11/2020)	- school-based survey in 13 secondary schools in Hong Kong - n=3136	- age: M=13.6 years	What is the role of stress related to schooling and online learning during COVID-19 in depression and Internet gaming disorder (IGD) among adolescents and what are the potential mediators of social support, academic stress, and maladaptive emotion regulation based on the framework of Conservation of Resources theory?	- The prevalence of probable depression was 60%. - The prevalence of probable internet gaming disorder (IGD) was 15%. - Covid-19 stress was positively and indirectly associated with depression and IGD through social support, academic stress, and maladaptive emotional regulation. - Associations between Covid-19 stress and academic stress, academic stress, and depression and between social support and depression were stronger among females compared to males.
Jesser A, Schaffler Y, Gächter A, Dale R, Humer E, Pieh C. (2022)	Austria (02/2021)	- cross-sectional online survey - n=214 (representative sample drawn from representative sample of 3052 adolescents)	- age: 14-20 years	What are young people's concerns and sources of support after one year of Covid-19? What is stressful? What is used to cope with stress?	- Concerns about educational and professional future increased. - The most important sources of support are social contacts, recreational activities, attitudes and abilities, distraction, and escape.
Green KH, van de Groep S, Sweijen SW, Becht AI, Buijzen M, de Leeuw RNH, Remmerswaal D, van der Zanden R, Engels RCME, Crone EA (2021)	Netherlands (05/2020, follow-up 11/ 2020)	- longitudinal two-week daily diary study - n=462	- age: adolescents M=15.27 years, young adults M=21.49 years	- What are the short-term and long-term effects of the pandemic on young people's mood? - What are the stressors on mood, emotional reactivity, self-oriented and other -benefitting behaviors?	- in May older participants showed higher levels and more fluctuations in tension and depression and lower levels of vigor. - Until November vigor levels decreased and tension and depression level increased. - Adolescents: positive association between stressors (inequality in homeschooling, family stressors) and negative emotions (tension and depression fluctuations).
Kang S, Sun Y, Zhang X, Sun F, Wang B, Zhu W. (2021)	China (03/2020)	- online questionnaires in 49 middle schools in 13 urban and rural areas in Yan'an, China - n=4898	- age: M=16.3 years (SD=1.3)	What is the relationship between physical activity and sedentary time with mood states among Chinese adolescents during COVID-19 pandemic?	- The preferred lifestyle during the pandemic was sedentary. - Higher mood disturbances were seen in females and in grade 3 of senior high school.

					- Physical activity was associated with improved mood states.
Commodari E, La Rosa VL. (2021)	Italy (04/2020-05./2020)	- online survey in upper secondary school - n= 1017	- age M=16.57 (SD=1.20) in the range of 13-20 years	What impact on students' well-being and learning process and what are future prospects?	- Distance learning is associated with an increased workload and homework-related psychological stress. - Students are more distracted, have problems with organizing study and are concerned about their future career due to the lockdown.
Li X, Tang X, Wu H, Sun P, Wang M, Li L. (2021)	China (04/2020)	- questionnaire based on checklist: COVID-19-Related Stressors (16 stressors subdivided into six groups: self-related events, family-related events, friend-related events, acquaintance-related events, information-related events, and other infectious disease-related events) - n=802	- age grade seven (M=12.95 n= 435), grade eight (M=13.79 n=189), grade nine (M=14.72 n=178)	What are main and interactive relations of COVID-19-related stressors, coping, and online satisfaction with Chinese adolescents' adjustment during the COVID-19 pandemic?	- COVID-19-related stressors were a vulnerability factor in predicting adjustment. - Adolescent's adjustment could be attributed to individual-level and class-level. - Problem-based coping and online learning satisfaction buffer against negative impact of stressors. - Emotion-based coping is a vulnerability factor for stressors. - Female and impoverished adolescents reported poorer adjustment during pandemic compared to male and adolescents in high socio-economic status.
Waters L, Allen KA, Arslan G. (2021)	Australia (2020)	- two-step analytic approach as a part of the ongoing SEARCH study questionnaire (strengths, emotional management, attention and awareness, relationships, coping, habits, and goals) at an independent school in New South Wales, Australia - time points: before school closures, during school closures, after return to school	- age: 13-18 years	- Will adolescents develop stress-related growth during COVID-19? - Is the degree to which students were taught positive education skills at school prior to the pandemic directly and positively related to their SRG (stress-related growth) upon school? - Is higher strength use, the use of emotional processing techniques and higher use of positive reappraisal during remote learning	- Teaching positive education prior to COVID-19 had positive correlations with the way students coped during remote learning and with SRG when returning to campus - Positive reappraisal, emotional processing, and strengths use was positively associated with SRG. - Positive education was a significant predictor of emotional processing, strength use and SRG - Emotional processing significantly predicted SRG of adolescents.

		- n=404		<p>related to higher levels of SRG when students return to school?</p> <p>- Is the use of emotional processing techniques during remote learning related to higher levels of SRG?</p> <p>- What is the association between positive education skills prior to the pandemic and their use of positive reappraisal, emotional processing, and strengths use during remote learning upon school entry and how does these factors influence SRG after the pandemic?</p>	- There is a partial mediating effect of emotional processing on the link between positive education and student SRG upon returning to campus during the COVID-19 outbreak.
Pfetsch JS, Schultze-Krumbholz A, Lietz K. (2022)	Germany (03/2021 – 04/2021)	- online study - n=205	- age: 14-19 years	<p>- Does cyberbullying perpetration function as maladaptive strategy to deal with feelings of loneliness and therefore predicts well-being?</p> <p>- Does the need to belong or emotion regulation problems moderated the association between cyberbullying and well-being?</p>	<p>- Well-being was significantly predicted by less emotion regulation difficulties, less feeling isolated and more cyberbullying perpetration</p> <p>- For students with a high need to belong, well-being was more strongly related to cyberbullying perpetration than for students with a medium need to belong.</p> <p>- cyberbullying perpetration predicted well-being positively.</p> <p>→ Cyberbullying may be a way of encountering others and to regulate loneliness maladaptively during social distancing.</p>
Metherell TE, Ghai S, McCormick EM, Ford TJ, Orben A. (2022)	United Kingdom (07/2020, 11/2020, 03/2021)	- mental health inventory from 2017-2019 compared to pandemic (July 2020, November 2020, March 2021) - n=1387	- age: 10-15 years	Do digitally excluded young adolescents demonstrate greater mental health deterioration than their digitally connected peers?	<p>- Worsening and recovery of mental health was pronounced among those without access to a computer.</p> <p>- Worsening and recovery of mental health was not pronounced among those with access to a computer.</p>

					- Access to a computer is a protective factor for mental health during periods of social isolation.
Guazzini A, Pesce A, Gino F, Duradoni M. (2022)	Italy (unknown)	- retrospective perception analysis administered during remote learning - n=917	- age: M=16.38 years (SD=1.54)	What are the changes in terms of use of technologies, loneliness, and sense of immunity?	- The pandemic increased the perception of loneliness, especially in girls. - The pandemic changed the use of technologies for social, informational and leisure purposes. Girls use technologies more than boys to stay in contact with their families. - The sense of community was not significantly impacted. → Adolescents feel more loneliness, especially in girls. Girls use technologies more than boys to stay in social contact.
Schunk F, Zeh F, Trommsdorff G. (2021)	Germany (05-06/2020)	- study 1: Cybervictimization frequency, emotional self-efficacy beliefs, aspects of well-being; n=107 - study 2: cybervictimization experiences, use of specific emotion regulation strategies, well-being; n= 205 (already included as a separate study)	- study 1 age: M=15.76 - study 2 age: M=15.45	Are emotional self-efficacy and distinct emotion regulation strategies potential mediators in the relationship between cybervictimization and lower well-being?	- Cybervictimization was related to lower well-being through lower self-efficacy for managing negative emotions. - Cybervictimization was related to lower well-being through more rumination, but not through reappraisal or suppression. → Cybervictims may have lower emotional self-efficacy beliefs and engage in more rumination, a maladaptive emotion regulation strategy.
Kostorz K, Zwierzchowska A, Ziemia M (2022)	Poland (2020-2021). Control study 2018-2019	- n=111 study - n=111 control study	- age: 14-21 years - control study age: 10-16 years	What is the student's perception of inclusion in school education during remote learning during pandemic? What is the physical activity of students during social isolation due to COVID-19?	- During remote learning student's reported decrease in emotional well-being at school but a higher degree of social relationship with other students compared with pre-pandemic. - The recommendations for vigorous physical activity were met by 37.78% of boys and 34.85% of girls.

					<ul style="list-style-type: none"> - The recommendations for medium physical activity were met by 69.70% of female students and 77.78% of male students. - The recommendations for total physical activity were met by 87.88% of girls and 86.67% of boys. - BMI shows a low positive correlation with academic competencies, whereas physical activity does not correlate.
Marciano L, Viswanath K, Morese R, Camerini AL. (2022)	Switzerland (T1 spring 2019; T2 autumn 2020)	Study as a part of the longitudinal MEDIATICINO study (self-reported mental health measures, screen-media activities) - n=674	- age: M= 14.45 (SD=0.5)	Does screen-time increase during COVID-pandemic and how does it affect adolescent mental health?	<ul style="list-style-type: none"> - Mental health problems increased over time (medium: anxiety, depression, and inattention; small-to-medium: loneliness, sleep problems, and obsessive-compulsive symptoms; small: somatic symptoms) - Screen-media activities increased and are associated with worse mental health. Structured media activities (like television) decreased inattention and anxiety. - Negative predictors for decreased mental health at T2: female sex, experiencing two or more life events, having mental health problems at T1, and using screens for homeschooling. → small but negative effect of social media time on mental health. → structured days hypothesis
Santos JS, Louzada FM. (2022)	Brazil (lockdown 07/20 and control 03-06/2019)	- cross-sectional online study at public high schools in Curitiba, Brazil - n=259	- age: M= 15.5	What are the adolescent sleep patterns due to the absence of 'the pressure to wake up earlier induced by school closures during COVID-19 pandemic?	<ul style="list-style-type: none"> - Tendency to eveningness was higher and daytime sleepiness was reduced during the social isolation. - Delayed sleep onset time - Time in bed increased for more than two hours

Zhou J, Yuan X, Qi H, Liu R, Li Y, Huang H, Chen X, Wang G. (2020)	China (02/2020)	- cross-sectional sample, nationwide - female sex - n= 4805	- age: 11-18 years	What is the incidence and the correlation of depression in females during COVID-19 outbreak?	- Depression increased in females during COVID-19 outbreak. - Independent risk factors for depression: older age, distant learning, concern about COVID-19, short sleep duration, and physical exercise duration.
Chen S, Cheng Z, Wu J. (2020)	China (02-03/2020)	- cross-sectional online study - n=7772	- grade 7-12 (corresponds to age: 12-17 years)	Does gender, grade in school, single child status, online learning participation, parents' involvement in COVID-19 related work, and parents being quarantined or infected due to the disease leads to clinically significant differences in anxiety and depression? These findings are extracted selectively from the article according to the research question of this systematic review.	- Positive predictive value for depressive and anxiety symptoms: online studies, participants' grade level, gender, relative being infected. - Indirect predictive value for depressive and anxiety symptoms: location and sibling status. Positive predictive value for depression: relatives participated in COVID-19 related work.
Wang J, Wang H, Lin H, Richards M, Yang S, Liang H, Chen X, Fu C. (2021)	China (04-05/2020)	- online survey as a cross-sectional analysis with data collected in middle and high schools in Taizhou, China - n=6435	- age: 15.6 years (SD=1.7)	What is the prevalence of depressive symptoms and their association with study-relevant problems and what is the moderating effect of parent-child relationship?	- Study problems were associated with higher rates of depression. - The association between number of study problems and symptoms of depression is lower in adolescents with a good parent-child relationship.
Musa S, Elyamani R, Dergaa I. (2022)	Worldwide (08/2021)	- Systematic review - n =41.687 (studies sample size ranged from n=474 to n=33.900)	- age: 12-18 years	What is the relationship of screen time of various types and the risk of metabolic syndrome in adolescents during COVID-19 pandemic?	- Negative association between screen time and components of metabolic syndrome with dose-response association.
Rahiem MDH, Krauss SE, Ersing R. (2021)	Indonesia (06/2021)	- Online reflective essays from students at the University of Jakarta - n= 166	- age: 17-22 years	What are the perceived consequences of extended social isolation on mental well-being?	- During COVID-19 related isolation students mostly felt: (1) the anguish of loneliness and estrangement; (2) a state of "brokenness"—emotional agony and distress; (3) frustration, confusion, and anger; (4) the experience of conflicting emotions; (5) uncertainty about current

					and future events; (6) a sense of purpose and fulfillment; and (7) turning to faith.
Katona ZB, Takács J, Kerner L, Alföldi Z, Soós I, Gyömörei T, Podstawski R, Ihász F. (2021)	Hungary (11-12/2020)	- self-reported questionnaire - n=2508	- age: 15-21 years	How did physical activity and screen time change during COVID-19 pandemic?	- The rate of physical activity decreased. - Less aerobic and muscle-strengthening exercises were performed. - Screen time increased, especially in young adults.
Poulain T, Meigen C, Kiess W, Vogel M. (2022)	Germany (T1 03/2020, T2 01/2021, T0 2029)	- online survey - longitudinal study - n=152	- age: 9-16 years	How does well-being, coping with homeschooling, and leisure behavior differ at two different periods of school closure? How did well-being change compared to pre-pandemic?	- In the timeframe of the pandemic, physical well-being and coping with homeschooling decreased, while social support increased. - Lower socio-economic status was associated with lower wellbeing, poorer coping with homeschooling, longer computer gaming duration, and a stronger decrease of concentration on schoolwork. - Well-being declined during COVID-19 pandemic compared to pre-pandemic.
Maiorani C, Fernandez I, Tummino V, Verdi D, Gallina E, Pagani M. (2022)	Italy (05/2020-06/2020)	- online questionnaire at two high schools in Lodi are (Italy) - n=148 representing sample of n=930	-age: 14-21 years	What is the psychological impact of the COVID-19 Pandemic and distance learning on students?	- 35% of students reported stress reactions. - “Distress entity” characterized by anxiety, depressive and somatic symptoms increased, especially in females. - Adolescents who expressed distress described a negative impact of distance learning.
Pelikan ER, Lüftenegger M, Holzer J, Korlat S, Spiel C, Schober B (2021)	Austria (04/2020)	- online questionnaire - n=2652	- age: M=14.56 years (SD=2.49)	How does self-regulated learning (SRL), intrinsic motivation and procrastination differ in students who perceived themselves as having high competency vs. low competency.	- Students with high self-regulated learning strategies are motivated more often and more intrinsically and procrastinate less than students with lower competence. - Students reported similar challenges (independent learning, time, and task management, learning on the computer, lack of contact with teachers and peers), but students with higher self-regulated

					learning competence coped better and had less supportive needs.
Cockerham D, Lin L, Ndolo S, Schwartz M. (2021)	United States (02/2020)	- mixed methods study: survey and interview - n=21	- age: 12-17 years	What are the perceptions and needs of adolescents during the pandemic?	- During pandemic positive affect decreased and negative affects increased. - High distractibility was reported by entertaining technologies. - Social interactions and connectedness decreased during online education. - Smartphones are also described as “connecting” and “necessary” for social interactions.
Korzycka M, Bójko M, Radiukiewicz K, Dzielska A, Nałęcz H, Kleszczewska D, Malkowska-Szkutnik A, Fijałkowska A. (2021)	Poland (04/2020)	- online survey - n=2408	- age: 11-18 years	What are the demographic differences in difficulties with remote learning perceived by students?	- Major problems are increased demand of teachers, lack of consultation, technical difficulties, and insufficient skills. - Difficulties related to distant learning are higher in rural areas and among 17-18-year-old adolescents due to poor organization of distant learning and lack of teachers.
Liu Y, Yue S, Hu X, Zhu J, Wu Z, Wang J, Wu Y. (2021)	China (02/2020-04/2020)	- online survey - n=5175	- age: M=13.37 years (SD=0.02)	What is the association between feelings and behaviors during COVID-19 pandemic lockdown and depression and anxiety after the lockdown?	- Risk factors for anxiety and depression are suicidal ideation, quarreling with parents, insomnia, difficulty in concentrating during online learning, and anxious and depressed mood during lockdown. - Risk factors for depression are living in urban and not living with parents. - Missing teachers was negatively associated with both depression and anxiety.
Liu S, Zou S, Zhang D, Wang X, Wu X. (2022)	China (04-05/2020)	- cross-sectional online survey - n=4852	- age: M=13.80 (SD=2.38) in the range of 10-18 years	What is the relationship between problematic internet use and academic engagement through psychopathological symptoms?	- Depression and anxiety are negatively related to academic engagement. - Insomnia related to depression and anxiety is a risk factor for decrease in academic engagement.

					- Problematic internet use associated with depression and insomnia is stronger observed in middle and late adolescence.
Pieh C, Dale R, Plener PL, Humer E, Probst T. (2021)	Austria (02/2021)	- cross-sectional online survey - n=2884	- age: M=16.47 (SD=1.44)	What is the stress level in high-school students after a semester of homeschooling?	- Around one-third of students reported high stress levels, especially females.
Bani-Issa W, Radwan H, Saqan R, Hijazi H, Fakhry R, Alameddine M, Naja F, Ibrahim A, Lin N, Naing YT, Awad M. (2023)	United Arab Emirates (02-05/2021)	- self-reported online questionnaire - n=1720	- age: 10-19 years	What is the association between quality of sleep and screen time during COVID-19 outbreak?	- Adolescents exposed to higher screen times experience poor sleep quality, especially sleep latency and sleep disturbances. - Smartphone were identified as the digital device used most often.
Schwartz KD, Exner-Cortens D, McMorris CA, Makarenko E, Arnold P, Van Bavel M, Williams S, Canfield R (2021)	Canada (09-10/2020)	- online questionnaire for students in Alberta - n=2310	-age: M=14.5 in the range of 12-18 years	- What are the experiences related to COVID-19 including concerns about personal, family, and national health, and the schooling experience at present and during lockdown? - How is COVID-19-related stress correlated with and predictive of self-reported mental health indicators?	- Concern for the personal health, family confinement and maintaining social contact increased. - Stress level was at critical range, where higher stress levels are seen in females and at younger (age 12-14 years). - Those with self-reported behavioral concern showed increased stress levels.
Qin Z, Shi L, Xue Y, Lin H, Zhang J, Liang P, Lu Z, Wu M, Chen Y, Zheng X, Qian Y, Ouyang P, Zhang R, Yi X, Zhang C. (2021)	China (03/2020)	- cross-sectional online study in Guangdong (China) - n=1199320	- age: M=12.04 years (SD=3.01)	What is the extend of self-reported distress among school-aged children and adolescents associated with the COVID-19 pandemic?	- High school students had an increased risk for psychological distress compared to younger students. - Students who wore a face mask and those who exercised less frequently showed an increased risk for distress.

Perkins KN, Carey K, Lincoln E, Shih A, Donalds R, Kessel Schneider S, Holt MK, Green JG (2021)	United States (06/2020)	- online survey at middle and high schools in Massachusetts - n=320	- grade 6-12 (corresponds to age: 11-18 years)	What is the association between school connectedness and mental health during remote learning due to COVID-19?	- School connectedness serves as a protective factor against anxiety and depression.
Bryce CI, Fraser AM. (2022)	United States (before pandemic 02/2020 and during pandemic 02/2021)	- online survey in Southwestern United States - n=726	- age: M=14.52 (SD=1.94)	- How is COVID-19 related to educational and life disruptions and what were the positive aspects during COVID-19 pandemic? - Does pre-pandemic hope improve feelings of school connectedness during pandemic?	- Distant learning was described as difficult and education has suffered mostly due to motivational loss. - Challenges during pandemic were school, COVID-19 and the future. - Positive aspects during pandemic were interpersonal relationship/interactions, school, and hobbies. - Pre-pandemic hope served as a predictor for school connectedness during pandemic.
Branquinho C, Kelly C, Arevalo LC, Santos A, Gaspar de Matos M. (2020)	Portugal (04-05/2020)	- online qualitative study - n=617	- age: 16-24 years	What is the impact of COVID-19 pandemic on adolescents? What are the coping strategies during COVID-19 pandemic?	- Adolescents reported more headaches and muscle pain, more time for pleasant and personal development activities and more symptoms of depression, anxiety, and loneliness, longer screen time, and more substance use, an increase in family conflicts and disagreement. - Loss of important life moments, contacts, and social skills were reported but it was described as allowing a greater selection of friendships. - Coping strategies were having a positive mindset, carrying out pleasurable activities, connecting with family and friends and establishing routines.
Albrecht JN, Werner H, Rieger N, Widmer N, Janisch D, Huber R, Jenni OG. (2022)	Switzerland (pre-pandemic)	- cross-sectional online survey at high schools in Zurich (Switzerland)	- age: M=16 years (IQR=15-17 years)	What is the association between homeschooling and adolescent sleep duration and health during COVID-19 pandemic school closure?	- The sleep period during school closure was 72 minutes longer which was associated with better health-related quality of life, and less caffeine consumption.

	05-07/2017, 05-06/2020)	- n=8972 (5308 included in control sample, 3664 included in the lockdown sample)			- Low health-related quality of life is positively associated with depressive symptoms and negatively related with caffeine consumption.
Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J. (2021)	Australia (T1: 2019, T2: 05.05.2020-14.05.2020)	- online survey as part of the longitudinal Risks to Adolescent Wellbeing Project (RAW Project) in New South Wales (Australia) - n= 248	- age: M=14.4 (from 13-16 years)	What is the impact of COVID-19 pandemic on adolescents' mental health? What are the moderators of change? What factors causing the most distress?	- Adolescents experienced an increase in depressive symptoms and anxiety and a decrease in satisfaction of life, especially pronounced in females. - Predictors for an increase in mental health problems were conflict with parents, COVID-19-related worries, and online learning difficulties. - Protectors for mental health were stay-at-home-orders and feeling socially connected during the pandemic.
Engel de Abreu PMJ, Neumann S, Wealer C, Abreu N, Coutinho Macedo E, Kirsch C. (2021)	Luxembourg, Germany, Brazil (05-07/2020)	- online self-reported questionnaire - n= 1613	- age: 10-16 years	What are the correlations of different dimensions of subjective well-being from different cultural contexts?	- Predictors of individual differences in subjected well-being during COVID-19 were gender, socioeconomic status, intrapersonal factors, quantity and type of schoolwork, and relationships with adults. - The strongest correlate of emotional well-being was fear of illness.
Collier Villaume S, Stephens JE, Nwafor EE, Umaña-Taylor AJ, Adam EK. (2021)	United States (T1: 12/2017-03/2020, T2: 03-07/2020)	- stress and mood questionnaire as part of an intervention study in Midwestern U.S. - n= 128	- age: M=15.22 (SD=0,62)	What are the changes in adolescents' perceived stress and mood early in pandemic?	- Perceived stress is higher in adolescents from low/moderate education families. Also, they reported to be more ashamed, caring, and exited compared to pre-pandemic. - Changes which appeared at the start of the pandemic, disappeared over time whereas home- and health-related stress stayed high for low/moderate education households.
Lan M, Pan Q, Tan CY, Law NWY. (2022)	Hong Kong (06-07/2020)	- self-reported data from adolescents and their parents - n=938	- age: females M=14.80 (SD=1.56), males M=15.00 (SD=1.60)	What are protective and risk factors affecting adolescents' well-being during COVID-19 pandemic?	- Self-efficacy in online learning during remote school was a key factor influencing perceived worries of adolescents after schools resumed.

					<ul style="list-style-type: none"> - Protective factors for well-being were identified as cognitive-emotional regulation for males and leisure-oriented digital activities for females. - Improvement in parent-child-relationship had positive effects on using positive emotional regulation strategies, self-efficacy in online learning, reduction of leisure-time digital activities.
Hertz MF, Kilmer G, Verlenden J, Liddon N, Rasberry CN, Barrios LC, Ethier KA. (2022)	United States (10-11/2020)	<ul style="list-style-type: none"> - online and telephone survey - n=567 	- age: 13-19 years	Does the mode of school instruction influence mental health and determine if school and family connectedness attenuate these relationships?	<ul style="list-style-type: none"> - Distant schooling was associated with poorer mental health and puts an increased risk on depression and suicide attempts compared to in-person-schooling. - School and family connectedness serve as a protective factor for buffering negative mental health outcomes.
Tesler R. (2022)	Israel (05-06/2021)	<ul style="list-style-type: none"> - cross-sectional research study - n=1019 	- age: 11-18 years	What are the experiences of remote learning in adolescents and how does it affect well-being?	<ul style="list-style-type: none"> - Factors associated increased well-being are male gender, high socioeconomic status, greater involvement in lessons in the past year, connection to the pedagogical team/school and peers. - Life satisfaction and self-rated health were positively associated with positive remote learning experiences.
Campbell K, Weingart R, Ashta J, Cronin T, Gazmararian J. (2021)	Georgia (03/2020)	<ul style="list-style-type: none"> - cross-sectional online survey - n=761 	- grade 9-12 (corresponds to age: 15-19 years)	<p>What is the knowledge on COVID-19 of adolescents?</p> <p>How does the behavior change and what sources do adolescents use to inform on the pandemic?</p>	<ul style="list-style-type: none"> - Most common sources for information on COVID-19 were peers and social media. - Mostly, adolescents understood social distancing, participated in preventing behaviors, performed proper handwashing, and staying at home. - Increase in screen time was reported.
Tzankova I, Compare C, Marzana D, Guarino A, Di Napoli I, Rochira A,	Italy (05-06/2020)	<ul style="list-style-type: none"> - Interview and content analysis - n=64 	- age: 16-19 years	What are the experiences of adolescents of the emergency adoption of online school learning during the first national lockdown in Italy?	<ul style="list-style-type: none"> - The challenges during the lockdown were schools' lack of organization, overwhelming demands, as well as experience of difficulties in concentration,

Calandri E, Barbieri I, Procentese F, Gatti F, Marta E, Fedi A, Aresi G, Albanesi C. (2022)					<p>stress and inhibited relationships with teachers and classmates.</p> <p>- Online school learning offered a new flexibility and autonomy in the organization of learning.</p>
Peng X, Liang S, Liu L, Cai C, Chen J, Huang A, Wang X, Zhao J. (2022)	China (04/2020)	<p>- cross-sectional online study in Guangdong province</p> <p>- n=39751</p>	<p>- age: M=14.79 years (SD 1.70)</p>	<p>- What are the effects of home-based learning during the pandemic?</p> <p>- What is the risk of depression, anxiety, and suicidality during the pandemic?</p>	<p>- The prevalence of depression was 16,3%, the prevalence of anxiety symptoms was 10,3% and the prevalence of suicidality was 20,3%.</p> <p>- Risk factors for depression, anxiety symptoms and suicidal ideation were female gender, in junior high school, with poor overall sleep quality and poor academic and performance and being very worried about getting infected with COVID-19.</p>
Wang Y, Xia M, Guo W, Xu F, Zhao Y. (2022)	China (07/2020)	<p>- online survey</p> <p>- n(group 1)= 1316, n(group 2)=668</p>	<p>- group 1 age: M=16.32 years (SD=0.63)</p> <p>- group age: M=20.20 years (SD 1.43)</p>	<p>How does online learning readiness and emotional competence affect academic performance during COVID-19 period?</p>	<p>- Group 1 (high school students): online learning readiness and emotional competence were positively associated with increased academic performance.</p> <p>- Group 2 (College students): online learning readiness was positively associated with increased academic performance.</p>

Questionnaire of the online survey

Umfrage zur Covid-19 Pandemie

FRAGEBOGEN FÜR SCHÜLER/INNEN im Alter von 15-20 Jahren

Hallo, wir laden dich ein diesen Fragebogen über das Homeschooling während der Coronapandemi auszufüllen. Die Umfrage folgt dem Prinzip der Anonymität und die Ergebnisse werden unter Einbeziehung aller Daten ausgewertet.

Bitte kreuze beim Ausfüllen des Formulars die für dich passenden Antwortmöglichkeiten an. Die Dauer zum Ausfüllen des Fragebogens beträgt etwa 5-10 Minuten.

Vielen Dank für deine Teilnahme und wertvolle Hilfe.

Diese Forschungsarbeit wird im Rahmen der Final Thesis im Studienfach "Humanmedizin" an der medizinischen Fakultät der Vilnius University in Litauen von Julia Schaffarzyk unter der Aufsicht vo Prof. dr. Sigita Lesinskienė durchgeführt.

* **Erforderlich**

1. ALLGEMEINE FRAGEN ZU DEINER PERSON

1. Dein Geschlecht: *

Markieren Sie nur ein Oval.

- weiblich
- männlich
- divers

2. Jahrgangsstufe: * Markieren Sie nur ein Oval.

- 9
- 10
- 11
- 12
- 13
- Andere

3. Dein Alter: *

4. Schulform: *

Markieren Sie nur ein Oval.

- Gymnasium
- Realschule
- Hauptschule
- Oberschule
- Gesamtschule
- Berufsbildende Schule
- Andere

5. 2. FRAGEN ZUR SCHULE * Wie haben sich diese schulischen Faktoren nach dem Fernunterricht für dich verändert? Bitte markiere die zutreffenden Antworten.

Markieren Sie nur ein Oval pro Zeile.

	Verbessert	Unverändert	Verschlechtert
Kommunikation mit Klassenkameraden?			
Kommunikation mit LehrerInnen?			
Lernerfolge/Noten?			
Konzentration während des Unterrichts?			
Allgemeines Wohlbefinden in der Schule?			

6. 3. FRAGEN ZUR GESUNDHEIT * Bitte markiere die zutreffenden Antworten.

Markieren Sie nur ein Oval pro Zeile.

	Verbessert	Unverändert	Verschlechtert
Schlaf			
Appetit			
Stimmung			
Lernkapazität			
Physische Aktivität			
Sicht (Sehstärke)			
Selbstbewusstsein			

7. 4. FRAGEN IM ZUSAMMENHANG MIT DER COVID-19-INFEKTION

Wie hat sich dein Wohlbefinden in der Schule nach der Covid-19 Pandemie in Bezug auf Beschränkungen verändert? Bitte markiere die zutreffenden Antworten.

Markieren Sie nur ein Oval pro Zeile.

	Verbessert	Unverändert	Verschlechtert
Maske tragen?			
Abstand halten?			
Bewegungseinschränkungen auf dem Schulgelände?			
Veränderungen des Stundenplans und der Unterrichtszeiten?			
Einschränkungen bei der Nahrungsaufnahme in der Schule?			
Einschränkungen beim Treffen von Freunden?			

8. 5. FRAGEN ZU VERÄNDERUNGEN AUßERHALB DER SCHULE

Wie haben sich deine Freizeit und Kommunikationsgewohnheiten zu Hause verändert nachdem du wieder zur Schule gegangen bist?

Bitte markiere die zutreffenden Antworten.

Markieren Sie nur ein Oval pro Zeile.

	Verbessert	Unverändert	Verschlechtert
Kommunikation mit Familienmitgliedern?			
Kommunikation mit Freunden?			
Interesse an Hobbies und weiteren außerschulischen Aktivitäten?			
Zeiteinteilung?			

9. 6. WEITERE FRAGEN IN BEZUG AUF COVID-19: *

Wie groß ist deine Angst dich in der Schule mit Covid-19 zu infizieren?

- Markieren Sie nur ein Oval.
- Ich habe keine Angst
- Ich bin nicht ängstlich, aber auch nicht angstfrei Ich habe Angst
- Ich habe große Angst
- Ich weiß es nicht

10. Was hat dir während des Homeschoolings nicht gefallen?

11. Was hat dir während des Homeschoolings gefallen?

12. Was gefällt dir nicht in der Schule seitdem du wieder Unterricht in Präsenz hast?

13. Was gefällt dir in der Schule seitdem du wieder Unterricht in Präsenz hast?

Vielen Dank für deine Teilnahme!

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