

## SLEEP PATTERNS AND SLEEP DISTURBANCES IN SCHOOL-AGE CHILDREN AMID COVID-19 PANDEMIC OUTBREAK

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### ABSTRACT

The pandemic outbreak and the global crises it has caused have brought to our lives many changes. Mental health issues are part of those consequences that have shown signs of coronavirus thread impacts, such as anxiety, depression, and obesity (etc.), including sleep disturbances. The psychological distresses have become part of all major stages of human life circle, without excluding the children. Pediatric sleep problems may occur due to the family dynamic changes that have come along with the pandemic crisis and impact in our lives, therefore the present study is focused on exploring the sleep patterns, sleep disturbances and other associated factors during COVID-19 pandemic outbreak in elementary school children. For the assessment of these issues we have used the Children Sleep Habits Questionnaire which is a parent – rated questionnaire that evaluates common pediatric sleep difficulties. The data were analyzed with the SPSS statistical software version 22. From the research we were able to come to conclusions about few sleep subscales that relate to common sleep problems in children such as: bedtime resistance, sleep onset delay, sleep anxiety, night waking, daytime sleepiness and parasomnia and have been able to compare the variable differences among the participant's school year. We did also demonstrate the relations between sleep disturbances and other factors such as: parenting style, time spending on media, physical activity, food habits (etc.), and we have come to surprising findings when we compared the data among pupils from two different school years in combination with the sleeping subscales.

**Keywords:** Sleep patterns, sleep health, children mental health, sleep disruptions, COVID-19.

### INTRODUCTION

The world is facing a new mental health trend due to coronavirus COVID-19 thread, and therefore changes in every person's mental state are worthy of our attention and important for the sake of the science as well.

The psychological distresses due to the pandemic outbreak have become part of all major stages of human life circle, without excluding the children. Especially during the lockdown, as a safety measure, which confined the children to their homes for an extended period of time, with schools remaining closed and students only allowed to follow online lessons, in order to reduce contagion and pressure on the healthcare system, there have always been concerns that because of the prolonged home confinement during a disease outbreak may affect physical and mental health of children<sup>1</sup>, and not only them.

The lockdown restriction can affect health and wellbeing through the reduction of physical activity and of exposure to daylight, and social isolation might increase the level of stress.

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<sup>1</sup> Wang C., Pan R., Wan X. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *IJERPH*. 2020;17:1729. doi: 10.3390/ijerph17051729

These changes can impact daily activities as well as the sleep/wake pattern and circadian rhythmicity.<sup>2</sup> The probability of emerging of sleep disturbances might be related to isolation and shielding that could result in sedentary behaviors, increased food consumption and weight gain. Moreover, sleep disturbances might also be associated to increased levels of stress, due to possible changes in family financial conditions, health concerns, and uncertainty about the future.<sup>3</sup> We should also consider that social distancing, advice to stay indoors, and remote learning can reduce exposure to sunlight, allow more flexibility in wake and sleep time, increase the opportunity to have prolonged daytime naps and favor the use of technology for long time during the day.

In addition, home confinement can lead to substantial changes of the lifestyle of children, their families with loss of the principal zeitgebers<sup>4</sup> that help maintaining a regular routine and sleep/wake schedule.

### LITERATURE REVIEW

The novel Coronavirus disease 2019 (COVID-19) has quickly spread across the globe since December 2019 and drastically changed daily life for billions of people. This pandemic and its associated societal response is thought to have wide-ranging impacts on youth development and child mental health.<sup>5</sup> Indeed, being forced to stay at home, reduce social interaction, minimize outings, boredom, and in parallel manage the attendant health risks, can have a major impact on psychological distress.<sup>6</sup>

It is known that sleep is crucial for child and adolescent health and wellbeing and the potential for sleep problems to emerge or worsen during home confinement is high. Sleep disorders greatly affecting the quality of life in children are frequently seen. Although it is stated in the literature that sleep disorders are observed from 30% to 50% of children, the percentage of those who can be diagnosed cannot exceed 4%.<sup>7</sup>

A previous survey-based study comparing post-traumatic stress symptoms in parents and children quarantined (most of them because of H1N1 and SARS infection) with those not quarantined found that the mean post-traumatic stress scores were four times higher in the first group.<sup>8</sup> Sleep disorders are common in the pediatric age and their prevalence is estimated to be around 25%.<sup>9</sup>

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<sup>2</sup> Altena E., Baglioni C., Espie C.A. Dealing with sleep problems during home confinement due to the COVID-19 outbreak: practical recommendations from a task force of the European CBT-I Academy. *J Sleep Res.* 2020;29 doi: 10.1111/jsr.13052.

<sup>3</sup> Becker S.P., Gregory A.M. Editorial Perspective: perils and promise for child and adolescent sleep and associated psychopathology during the COVID-19 pandemic. *J Child Psychol Psychiatr.* 2020;61:757–759. doi: 10.1111/jcpp.13278.

1. <sup>4</sup> **Zeitgebers** - /'zaitgeibə/ - a rhythmically occurring natural phenomenon which acts as a cue in the regulation of the body's circadian rhythms. – retrieved from OXFORD Language at: <https://languages.oup.com/google-dictionary-en/>

<sup>5</sup> Golberstein E, Wen H, Miller BF. Coronavirus disease 2019 and effects of school closure for children and their families—reply. *JAMA Pediatr.* 2020;(2):211–2. <https://doi.org/10.1001/jamapediatrics.2020.3598>.

<sup>6</sup> Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet.* 2020;395(10227):912–20. [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8).

<sup>7</sup> Carter KA, Hathaway NE, Lettieri CF. Common sleep disorders in children. *Am Fam Physician.* 2014;89:368-377.

<sup>8</sup> Sprang G, Silman M. Posttraumatic stress disorder in parents and youth after health-related disasters. *Disaster Med Public Health Prep.* 2013;7(1):105–10. <https://doi.org/10.1017/dmp.2013.22>.

<sup>9</sup> Owens J. Classification and epidemiology of childhood sleep disorders. *Sleep Med Clin.* 2007;2(3):353–61. <https://doi.org/10.1016/j.jsmc.2007.05.009>.

There are few systematic studies of the impact of the current pandemic on children. Among these, some have found frequent alterations in sleep routines, increased total sleep duration, and negative impact on sleep quality.<sup>10,11</sup>

While in another Italian study, the impact of COVID-19 emergency measures on children and adolescents' well-being, and the possible risk factors of distress were investigated, where the authors did find out that there was an increase in sleep disorders that significantly impact children's quality of life.<sup>12</sup>

Quality and appropriate sleep are valuable for the growth and development of children. Sleep disorders bring many problems along with them. Therefore, early diagnosis and treatment of sleep disorders, especially in childhood, is crucial.<sup>13</sup>

### **Purpose**

Amid pandemic outbreak a lot of research studies have been conducted in the mental health field, but since the coronavirus thread has resulted to be less dangerous for the children's physical wellbeing, somehow the researchers have neglected this group age and their mental health too. Therefore, the purpose of the present study is to provide detailed data of the impact of COVID-19 pandemic outbreak on children sleep patterns and sleep disturbances, as well as highlighting the importance of the link between sleep health and family related factors.

With this survey, we aimed to evaluate the effects of COVID-19 quarantine on sleep quality as an indicator of psychological well-being among children living in North Macedonia. Secondly, we aimed to identify potential familial, socioeconomic, and personal risk factors for their occurrence.

### **Research methods**

We have selected the participants of this study by the so called cluster sampling" in the city of Struga, in a public elementary school, North Macedonia. The survey included 85 respondents divided by their school year (2<sup>nd</sup> and 5<sup>th</sup> grade).

For the assessment of the sleep patterns and disturbances among children we have used the Children Sleep Habits Questionnaire which is a parent – rated questionnaire that evaluates common pediatric sleep difficulties. For data collection we have used the 'snowball' sampling technique, which is an online software platform, the one we used is called Survey Planet. . The data were analyzed with the SPSS statistical software version 22.

### **Hypothesis**

1. Children's sleep patterns and disturbances differ according to their age/school grade.
2. Children's patterns differ for the sleep subscales: parasomnias, night waking and daytime sleepiness disorder among 2<sup>nd</sup> and 5<sup>th</sup> graders.
3. Time spent on screen influences the quality of sleep and the increase of sleep disturbances in children.
4. Higher levels of screen (technology) used by children, delays the onset sleep time.
5. Children that have changed their food habits during the pandemic outbreak, experience higher levels of sleep disturbances.

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<sup>10</sup> Dellagiulia A, Lionetti F, Fasolo M, Verderame C, Sperati A, Alessandri G. Early impact of COVID-19 lockdown on children's sleep: a 4-week longitudinal study. *J Clin Sleep Med*. 2020;16(9):1639–40. <https://doi.org/10.5664/jesm.8648>.

<sup>11</sup> Moore SA, Faulkner G, Rhodes RE, Brussoni M, Chulak-Bozzer T, Ferguson LJ, et al. Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: a national survey. *Int J Behav Nutr Phys Act*. 2020;17(1):85. <https://doi.org/10.1186/s12966-020-00987-8>.

<sup>12</sup> Dondi, A., Fetta, A., Lenzi, J. *et al.* Sleep disorders reveal distress among children and adolescents during the Covid-19 first wave: results of a large web-based Italian survey. *Ital J Pediatr* 47, 130 (2021). <https://doi.org/10.1186/s13052-021-01083-8>

<sup>13</sup> Bhargava S. Diagnosis and management of common sleep problems in children. *Pediatr Rev*. 2011;32:91-98.

6. Children who live in a less harmonious family atmosphere tend to experience higher levels of sleep distortions in comparison to those who live in a harmonious one.

### Findings and Results

#### Group Statistics

	Q1 Childrens school grade	N	Mean	Std. Deviation	Std. Error Mean
Bedtime resistance	>= 2	44	10.09	3.116	.470
	< 2	41	12.17	3.122	.488
TotalSleep	>= 2	44	39.98	7.890	1.189
	< 2	41	45.54	7.553	1.180
SleepOnsetDelay	>= 2	44	10.14	2.474	.373
	< 2	41	10.44	2.134	.333
SleepAnxiety	>= 2	44	19.52	5.655	.852
	< 2	41	24.17	5.477	.855

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Bedtime resistance	Equal variances assumed	.035	.853	3.072	83	.003	-2.080	.677	-3.426	-.733
	Equal variances not assumed			3.072	82.558	.003	-2.080	.677	-3.427	-.733
TotalSleep	Equal variances assumed	.283	.596	3.313	83	.001	-5.559	1.678	-8.897	-2.222
	Equal variances not assumed			3.318	82.936	.001	-5.559	1.675	-8.891	-2.227
SleepOnset Delay	Equal variances assumed	2.072	.154	-.602	83	.549	-.303	.503	-1.303	.697
	Equal variances not assumed			-.605	82.522	.547	-.303	.500	-1.297	.692
SleepAnxiety	Equal variances assumed	.233	.630	3.845	83	.000	-4.648	1.209	-7.053	-2.243
	Equal variances not assumed			3.849	82.871	.000	-4.648	1.208	-7.050	-2.246

**Table1. Data of children's sleep patterns and disturbances according to their school grade.**

From the results that we have achieved through the Levene's Test for equality of variances, we were able to conclude that children have different sleep patterns and disruptions in general, referring to their age. By looking at the table we can verify this hypothesis through the result under Total sleep, referring to the general sleep problems, where we have achieved a result of ( $p=0.01 < 0.05$ ) which indicates that there is a significant statistical difference between the variables. By looking at the means achieved by two group ages/grades we come to conclusions

that 2<sup>nd</sup> graders elementary schoolers suffer and express more sleep disruption issues than 5<sup>th</sup> grade pupils.

The sleep pattern differences are statistically significant also on the subscale 'Bedtime resistance' where ( $p=0.03 < 0.05$ ) meaning we reject the null hypothesis. Again the 2<sup>nd</sup> graders score higher in this subscale *too*.

The same is valid for the presence of sleep anxiety among children, where we confirm that our hypothesis is verified by the statistically significant difference result ( $p=0.000$ ) which is lower than the significance level 0.01. Sleep anxiety is more present in 2<sup>nd</sup> grade pupils in comparison to 5<sup>th</sup> graders.

We accept null hypothesis for the subscale of 'Sleep onset delay', meaning there is no difference among the means of respondents scores. ( $p=0.59 > 0.05$ ).

### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
DAytimesleep	Equal variances assumed	.000	.983	-.032	83	.975	-.008	.246	-.497	.482
	Equal variances not assumed			-.031	81.444	.975	-.008	.247	-.499	.483
NIghtWaking	Equal variances assumed	5.819	.018	1.200	83	.234	-.111	.092	-.295	.073
	Equal variances not assumed			1.193	78.656	.236	-.111	.093	-.296	.074
Parasomnia total	Equal variances assumed	.355	.553	3.160	83	.002	-1.869	.591	3.045	-.693
	Equal variances not assumed			3.148	80.370	.002	-1.869	.594	3.050	-.687

**Table2. Statistical analyses for sleep subscales differences among children**

2.The statistical differences apply for the subscale of 'parasomnia', where we see from the Levene's Test at table2. that ( $p > 0.002$ ) which is lower than the significance level 0.01, meaning that there is significant difference between the means of the variables. Referring the results we can understand that 2<sup>nd</sup> graders are those who manifest more of parasomnia behaviors during sleep than pupils of the 5<sup>th</sup> grade. Also referring to the subscale of 'night waking' we judge

by the significance level that ( $p=0.018$ )  $< 0.05$ , there are significant differences, and by looking at the participants item means we figure out that again 2<sup>nd</sup> graders are those who manifest this sleep disturbance more often than 5<sup>th</sup> graders.

We came to another conclusion that referring to the subscale of the inventory 'daytime sleepiness' there's not any statistical differences between the respondents of 2<sup>nd</sup> and 5<sup>th</sup> grade.

## ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Bedtime resistance	Between Groups	50.122	4	12.530	1.181	.326
	Within Groups	849.126	80	10.614		
	Total	899.247	84			
TotalSleep	Between Groups	242.210	4	60.552	.902	.467
	Within Groups	5372.896	80	67.161		
	Total	5615.106	84			
SleepOnsetDelay	Between Groups	34.843	4	8.711	1.690	.160
	Within Groups	412.380	80	5.155		
	Total	447.224	84			
SleepAnxiety	Between Groups	36.510	4	9.127	.244	.913
	Within Groups	2996.784	80	37.460		
	Total	3033.294	84			

**Table3. Data analyzes for time spent on the internet and quality of sleep subscales.**

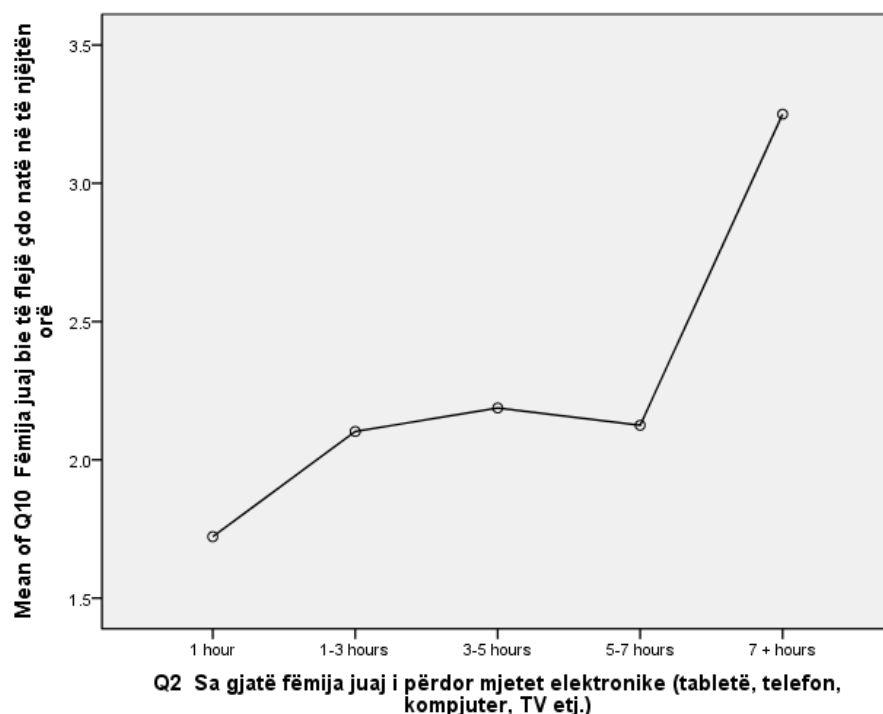
3.Regarding the comparative means by Anova method, to determine whether the time spent on the internet influences the quality of sleep in these subscales: sleep in general, bedtime resistance, sleep onset delay and sleep anxiety, we didn't find any statistical differences among those variables. In other words we didn't find any sleep issues among children who spend more or less time using media technology, meaning that it does not represent a factor that interferes with sleep issues.

## ANOVA

Q10 Sleep in set timing

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.984	4	1.996	4.067	.005
Within Groups	39.263	80	.491		
Total	47.247	84			

**Table4. Sleep in set timing and screen time data analyzes.**



4. Regarding the table data from the Anova test, table 3, and the graph 1., we can conclude that there are significant differences between the means of the respondents referring the variables of media technology time spent and sleep in set timing. We come to a conclusion that children who use technology/media for longer hours during the day, are also the one's go to bed on different time at night, meaning that these children have issues with the onset sleep time.

**Independent Samples Test**

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Total Sleep	10.362	.002	-2.379	83	.020	-4.507	1.894	-8.275	-.739	
Equal variances assumed			-2.036	33.59	.050	-4.507	2.213	-9.006	-.007	
Equal variances not assumed				2						

**Table 5. Diet and sleep health data analyses.**

5. Regarding the comparative means through the Levene's Test to determine whether diet represents an important factor that influences children's sleep health in general, we were able to prove this point of our research study by confirming our hypothesis. Referring the data analyzes we got the following results where the sig. value ( $p=0.002$ ) is lower than the alpha value 0.05, therefore we confirm that there are significant differences between the means.

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
SleepAnxiet	Equal variances assumed	1.687	.198	.613	83	.542	.806	1.316	-1.811	3.423
	Equal variances not assumed			.622	82.562	.536	.806	1.296	-1.772	3.384

**Table6. Data analyzes based on the family harmony and quality of sleep.**

6. Referring to the evaluation of our data analyses we were able to conclude that ( $p=0.806$ ) which is greater than our alpha value 0.05, meaning that we accept null hypothesis, that there is no statistically significant difference between the means of the variables, therefore we reject our hypothesis that there is a significant difference of quality of sleep among those children who live in a harmonious family and those that live in a less harmonious one.

## CONCLUSIONS AND RECOMMENDATIONS

Regarding our findings we have ended up with the following conclusions:

Second graders experience higher levels of sleep disturbances (in general); manifest bedtime resistance at bedtime; suffer from sleep anxiety; show more of parasomnia signs and have more frequent night waking issues, significantly more, in comparison to 5<sup>th</sup> graders. There is no statistical difference between the pupils on the subscale of 'sleep onset delay' and daytime sleepiness disorder.

The use of technology hasn't appeared to influence the quality of sleep as assumed, but it has shown a side effect on 'sleep onset delay' subscale on those children who tend to use technology media for longer hours during the day.

Children that have changed their food habits during the pandemic outbreak experience higher levels of sleep disturbances.

The family atmosphere hasn't proved to be an impact factor related to sleep health in children since we couldn't find any statistical significant differences that proved the contrary.

In summary, our research study findings have highlighted the importance of children sleep health during pandemic outbreak, and its link to alternative factors. Future studies should include assessment of other factors that could be related to sleep disruptions such as health concerns, academic performance during the period through e-learning, family financial stability, social anxiety due to social isolation etc. in order to further explore and contribute in children's mental health.

### Limitations

We think that the inherent limitation of parent response-based questionnaires may not always coincide with the child's perception and be influenced by numerous factors including parental stress itself.



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