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The impact of lockdown on sleep patterns of children and adolescents with ADHD

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ABSTRACT

Study Objectives: The current study examined the impact of home confinement (lockdown) due to the COVID-19 pandemic on sleep patterns of children and adolescents with ADHD.

Methods: Nine hundred ninety-two parents of children and adolescents with ADHD filled out an anonymous online survey through the ADHD family association website. The survey investigated the sleep patterns and disturbances (using a modified version of the Sleep Disturbance Scale for Children) and screen exposure time before and during the lockdown.

Results: During the lockdown, 59.3% of children and 69.4% of adolescents with ADHD reported a change of bedtime with significant increase of ADHD patients that went to sleep at 11pm or later. Sleep duration, in contrast, resulted in two opposing processes with more children and adolescent sleeping either less than 6 hours/night or 10-11 hours/night. Among children and adolescents, respectively, 19.9% and 22% slept less than they did before lockdown, while 21.4% and 27.4% slept more hours. Bedtime delay and decreased sleep duration were associated with an increase in the screen time exposure. Moreover, ADHD patients reported an increase in sleep disturbances when compared to previous condition, including mainly difficulties falling asleep, anxiety at bedtime, night awakenings, nightmares and daytime sleepiness.

Conclusions: The lockdown impacted on sleep-wake rhythms by strengthening the maladaptive sleep patterns reported in usual life conditions in ADHD children.

Keywords: COVID-19; attention deficit hyperactivity disorders; sleep-wake patterns; sleep disorders; children; adolescents

BRIEF SUMMARY

Current Knowledge/Study Rationale: Children with ADHD are easily intolerant to forced restrictions and rules and might result particularly vulnerable to the lockdown experience and might show alterations of their sleep patterns. Furthermore, limitation of activities and relationships due to lockdown might cause an increase of screen exposure time that might affect sleep of subjects with ADHD.

Study Impact: Our findings highlight that lockdown impacted on sleep-wake rhythms by strengthening the maladaptive sleep patterns reported in usual life condition in ADHD children.
The lockdown significantly delayed bedtime and increased daytime screen exposure in subjects that reduced their sleep duration, in particular. The increase in sleep disturbances, mainly difficulties falling asleep, anxiety at bedtime, night awakenings, nightmares and daytime sleepiness might further affect daytime functioning in children and adolescents with ADHD.

INTRODUCTION

The lockdown restriction for the COVID-19 pandemic has caused critical physical and mental health problems in the entire population due to social isolation and the impossibility to engage in varied and satisfying activities.[1,2] One of the most frequently reported consequences caused by the confinement regards the alteration of sleep-wake rhythms in children, adolescents and their families.[3,4] Considering the crucial role that sleep plays on developmental processes, the individuation of the impact of confinement on sleep-wake patterns and sleep disturbances have represented a crucial field of investigation for child and adolescent psychiatrists.

Based on previous studies, two important factors have associated the altered sleep patterns in children and adolescents and adult population to the lockdown: 1) stress and anxiety linked to the COVID-19 infection,[5] 2) the increased use of media and screen exposure due to highly reduced possibility of alternative activities.[3]

Most studies have been conducted on the general population, although it is reasonable to expect that patients with developmental disorders might be a population at higher risk.

Children and adolescents with ADHD are often intolerant to forced restrictions and to accept rules.[6] Therefore, changes imposed by lockdown with lack of specific rhythms (school, sports or leisure activities) can potentially promote critical variations in their sleep patterns. Moreover, since the restrictions significantly limit pleasant activities, the consequent use of social media and TV might represent an important aspect that interferes with the regular sleep schedule.[3,7] The understanding of the impact of lockdown on sleep of children and adolescents with ADHD and the evaluation of the factors that promote unhealthy changes represent a research area of high priority.

Therefore, the aims of this study were: 1) to assess sleep patterns and sleep disturbances in Italian children and adolescents with ADHD confined at home during the COVID-19 pandemic, as compared to their sleep habits before confinement; 2) to identify the relationship between screen time exposure and sleep patterns during the lockdown period.

METHODS

Participants

A total of 992 participants [males = 847 (85.4%); females = 145 (14.6%), mean age 11.52 years, S.D. 3.17] completed the survey. All parents with a child or adolescent that was diagnosed with ADHD by a child and adolescent psychiatrist of the respective Mental Health Services were informed of the survey through the Italian ADHD Family Association website.

The total sample can be considered as representative for the entire Italian territory with a participation of all regions, 20 metropolitan cities and 78.3% (72/92) of the Italian provinces. Data reported in this study were part of a wider research project designed with multiple purposes regarding the psychological impact of home confinement in Italy. There was no monetary or credit compensation for participating in the study. The study was approved by the Ethics Committee of the Department of Developmental and Social Psychology, Sapienza University, Rome and was conducted in accordance with the Declaration of Helsinki.

Procedures

An anonymous online survey to be completed by parents was arranged for this study in order to evaluate the effect of the lockdown on sleep patterns and disturbances and on the use of social media and total daily screen time exposure in children and adolescents with ADHD.

Data were collected with a survey advertised through the National ADHD Family Association website, for a limited time window (from June 4 to June 21, 2020), targeting patients with ADHD aged 5 to 18 years. Before accessing the survey, parents were asked to read the written consent form and to agree

to participate in the study. Informed consent represented a required field for advancing in the compilation of the questionnaire.

The questions investigated sleep habits (duration and bedtime) and sleep disturbances, in order to evaluate the differences before and during the lockdown, along with demographic information of the compiler (gender, caregiver education) and family composition. Moreover, screen exposure time (2-3 hours/day, half of the day, most of the day), excluding the hours spent for online lessons, and device preferences (videogames, internet, TV, mobile phones) were also assessed.

Instruments

The Sleep Disturbance Scale for Children (SDSC) by Bruni et al.[8] investigates the occurrence of sleep disturbances based on 26 items in a Likert-type scale, with values 1-5 (higher numerical values reflect a higher clinical severity of symptoms). For the purpose of this study and in order to facilitate the compilation by parents, we selected specific questions to evaluate the prevalence before and during lockdown. Some questions were grouped into one (i.e. sleep disordered breathing) and other questions, not relevant for the time period, were excluded. The final questionnaire was composed of 13 items.

Statistical analyses

Descriptive statistics were applied to characterize sociodemographic variables, sleep patterns and sleep disturbances. Data were reported as frequencies and percentages. The McNemar nonparametric Chi-square test was used to compare sleep patterns and sleep disturbances and the use of social media, before and during the lockdown.

In order to assess the changes occurring during the lockdown, bedtime and sleep duration were re-coded into three categories: bedtime was classified as delayed, anticipated, or no change, sleep duration as increased, decreased, or no change; a cross-tabulation analysis was then performed between them and with screen exposure time.

The Chi-square test was used to compare children vs. adolescents on sleep patterns and sleep disturbances during the lockdown. For all comparisons p-values less than 0.05 were considered as statistically significant.

Statistical analyses were performed using the SPSS software release 17.0 (SPSS INC, Chicago, Illinois).

RESULTS

The total sample was composed by 528 children [441 males (83.5%); 87 females (16.5%); age range 5-11.11 years; mean age 9.1 years, S.D. 1.63] and 464 adolescents [406 males (87.5%); 58 females (12.5%); age range 12-17.1 years; mean age 14.3 years, S.D.1.92]. Sex composition of the two age groups was not statistically different (χ^2=3.130; p=.077).

Family economic status of the whole sample was high in 3%, middle in 75.2% and low in 21.8% of them. Mothers were the main compilers of the survey (88.6%).

As for the education level, the majority of compilers had a graduate (29%) or high school degree (52.6%); middle school was reported by 17.9% and elementary school by 0.5% of them. The family composition was reported as follows: parents with one offspring member 31.3%; parents with two offspring members 51.9%; parents with three offspring members 13.3%; parents with four or more offspring members 3.5%.

During the lockdown, we found a significant delay of bedtime in both children and adolescents: there was a significant reduction of the number of ADHD patients that went to bed at 8-10 p.m. with an increase in the number of ADHD patients that went to bed at 11 p.m. or later (Table 1). Compared to children, adolescents showed a higher percentage of subjects that went to bed ≥12 a.m. and a lower percentage at 8-10 p.m. and 10-11 p.m (Table 1).

Bedtime was delayed in 59.3% (313/528) of children and 69.4% (322/464) of adolescents and no change was reported by 40.7% (215/528) of children and 29.7% (138/464) of adolescents. Only 0.9% (4/464) of adolescents advanced the bedtime (figure 1).

In contrast, with regard to sleep duration, we found trends in opposite directions. There was an increased percentage of subjects that slept less than 6 hours/night (with higher rates in adolescents) and a higher rate of participants that slept 10-11 hours/night or more (with higher rates in children), while the percentage of subjects that slept 8-9 hours per night decreased (Table 2).

During the lockdown, sleep duration changed in 41.3% of children and in 49.4% of adolescents; in particular, sleep duration decreased in 19.9% and 22%, increased in 21.4% and 27.4% and maintained in 58.7% and 50.6% of children and adolescents, respectively (figure 2).

Figure 3 reports the interaction between bedtime and sleep duration showing that, among subjects that delayed the bedtime, a high percentage of children (77.9%) and adolescents (82.7%) increased sleep duration but also a high percentage of children (83.8%) and adolescents (89.2%) decreased sleep duration, while 44.2% of children and 53.6% of adolescents did not change sleep duration.

Figure 4 shows that, among participants that did not change their bedtime, 22.1% of children and 15.7% of adolescents increased sleep duration, 16.2% of children and 9.8% of adolescents decreased sleep duration, and 55.8% of children and 46% of adolescents maintained the same sleep duration (figure 4).

Finally, among the four (0.9%) adolescents that anticipated bedtime, two increased sleep duration, one reduced it, and one maintained the same sleep duration.

Both children and adolescents with ADHD significantly increased the use of leisure screen time, during the lockdown, with the exception of the use of TV (Table S1 in the supplemental material). Age group comparison highlighted that children made greater use of TV while the adolescents spent more time with internet and mobile phone (Table S1). Overall, we observed that 64.2% of children and 72% of adolescents spent half or most of the time/day in front of a screen.

Table 3 reports the cross-tabulation between screen time exposure and delayed and maintained bedtime. Adolescents with bedtime delay used screen time most of the day in a significantly higher percentage than those who maintained the same bedtime. Conversely, children and adolescents that maintained their bedtime used screen time for 2-3 hours in a significantly higher percentage.

Table 4 includes the cross-tabulation between screen time exposure and sleep duration. Children and adolescents with a decreased sleep duration used screen time most of the day in a significantly higher percentage than those who maintained or increased sleep duration. Conversely, children and adolescents that maintained the same sleep duration used screen time for 2-3 hours in a significantly higher percentage.

Based on the SDSC, during the lockdown, both children and adolescents with ADHD showed an increase of sleep disturbances mainly related to falling asleep, anxiety at bedtime, night awakenings and daytime sleepiness, when compared to previous conditions (Table 5). Comparing the different age groups, we found that children reported an increase in nightmares, anxiety at bedtime, and bruxism, while adolescents showed an increase of daytime sleepiness (Table 5).

Daytime sleepiness was significantly prevalent in children (60/313=19.2% vs. 26/215=12.1%; χ^2 4.681; p=0.031) and in adolescents (113/322=35.1% vs. 27/138=19.6%; χ^2 15.934 p <0.001) that delayed their bedtime, with respect to those that maintained it. Furthermore, daytime sleepiness increased in children (29/105=27.6% vs. 39/310=12.6%; χ^2 11.066; p=0.004) and in adolescents (44/102=43.1% vs.48/235=20.4%; χ^2 15.934 p <0.001) that reduced sleep duration, compared to those that maintained it. Interestingly, adolescents that increased their sleep duration (49/127=38.6%) showed also a higher daytime sleepiness than those that maintained it.

No differences were found for co-sleeping (children: 23.7% vs. 24.8%; adolescents: 7.8% vs. 7.3%) and for the use of over-the-counter products for sleeping (children: 18% vs. 19.5%; adolescents: 21.3% vs. 21.1%).

DISCUSSION

Our results show that lockdown restriction for the COVID-19 pandemic affected the sleep-wake rhythm of subjects with ADHD, disrupting in dramatic way the previous habits of bedtime and sleep duration. Approximately 60% of children and 70% of adolescents reported a delay in their bedtime and around 40% of children and 50% of children and adolescents showed also a significant change in their sleep duration. These percentages are higher than those reported among typically developing children and adolescents.[7] Moreover, as reported in other studies in children and in the adult general population,[3,9,10] our results show that the delay of bedtime and reduced sleep duration were related with the increased time of screen exposure.

In general, accordingly with several reports conducted either in preschool children[11] and in older children and adults,[3,12] the lockdown condition causes the disruption of previous sleep-wake habits, independently by age and mental health condition. Altogether, the lockdown appears to be a reinforcing factor of the maladaptive sleep habits and the instability of the sleep-wake system that have already been reported in ADHD patients, in general.[13] Different studies have reported an increase of sleep duration in typically developing children and adolescents during the lockdown,[5,12,14] probably because home confinement allowed a better alignment with their sleep requirements.[15,16]

Our findings provide further critical information and highlight that both children and adolescents that delayed bedtime showed either an increased or decreased sleep duration. However, only the ADHD participants that delayed bedtime and decreased sleep duration reported an increased time of screen exposure.

It is noteworthy that, in other studies in children and in the adult general population,[3,8,9] delayed bedtime was related to screen exposure but sleep duration remained unchanged, or increased.

Furthermore, we observed an increase in daytime sleepiness that was related, in both age groups, with a bedtime delay and a decrease of sleep duration. In adolescents, we also saw an increase in daytime sleepiness that was associated with an increase in sleep duration.

This finding is alarming considering that, in Italy, regular academic activities at school have been interrupted for adolescents and the persistence of this condition could represent a risk factor of stabilization of disrupted sleep patterns and screen addiction. A further critical data is the increase of sleep disturbances recorded during the lockdown. In normal conditions, several studies reported a high prevalence of parent-reported sleep disturbances in school-age children with ADHD[17,18,19] with approximately one third of children who experience chronic sleep onset insomnia,[20] as well as night awakenings, restless sleep, and difficult morning awakening.[13,17,21,22,23] Our findings highlight that the lockdown increased also the vulnerability to sleep disturbances common among children and adolescents with ADHD, with the aggravating circumstance of anxiety at bedtime and nightmares presumably linked to worries for the COVID-19 infection.

Some limitations of this study must be acknowledged: 1) we did not evaluate specifically the influence of psychiatric comorbidity, and therefore we cannot exclude the influence of psychiatric comorbidity on habits and sleep disorders; 2) although the survey was conducted after only a few days from the end of the strict lockdown and in the presence of lighter restrictions, we cannot exclude a memory bias of the parents. Nevertheless, the large sample size of our study, representative of the ADHD Italian population, makes us confident that our findings reflect the impact of the lockdown experience on sleep patterns of ADHD population. The major challenge after the pandemic will be to identify its sequelae and to assess if ADHD patients will experience long-term disrupted sleep habits. It is crucial that sleep concerns must be part of research initiatives aimed at mitigating the consequences of the COVID-19 pandemic related restrictions in children and adolescents with ADHD.

ABREVIATIONS

ADHD = attention deficit hyperactivity disorders

SDSC= Sleep Disturbance Scale for Children

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Table 1. Comparison of bedtime before-during lockdown in children and adolescents with ADHD and age groups comparison.

Bedtime		Before n (%)	During n (%)	χ^2	$P <$	C vs. A	
						χ^2	$P <$
8-10 pm	C	452 (85.6)	165 (31.2)	285.003	0.0001	42.3877	0.0001
	A	239 (51.5)	64 (13.8)	169.140	0.0001		
10-11 pm	C	66 (12.5)	176 (33.3)	66.006.	0.0001	10.135	0.001
	A	151 (32.5)	112 (24.1)	7.482	0.006		
11 pm to 12 am	C	7 (1.3)	136 (25.8)	117.871	0.0001	0.330	NS
	A	49 (10.6)	127 (27.4)	38.006	0.0001		
≥12 am	C	5 (0.9)	41(7.8)	34.028	0.0001	98.449	0.0001
	A	22 (4.7)	152 (32.8)	126.068	0.0001		

C = children; A = adolescents; NS = not significant.

Table 2. Comparison of sleep duration before-during lockdown in children and adolescents with ADHD and age groups comparison.

Hours		Before n (%)	During n (%)	χ^2	P <	C vs. A χ^2	P <
< 6	C	14 (2.7)	28 (5.3)		0.004*	18.604	0.0001
	A	26 (5.6)	61 (13.1)	21.811	0.0001		
6-7	C	78 (14.8)	85 (16.1)	.371	NS	5.590	0.018
	A	132 (28.4)	102 (22)	5.923	0.015		
8-9	C	318 (60.2)	269 (50.9)	12.909	0.0001	2.991	NS
	A	271 (58.4)	210 (45.3)	20.112	0.0001		
10-11	C	114 (21.6)	139 (26.3)	4.608	0.032	10.680	0.001
	A	31 (6.7)	82 (17.7)	30.120	0.0001		
≥ 12	C	4 (0.8)	7 (1.3)		NS *		NS**
	A	4 (0.9)	9 (1.9)		NS *		

*McNemar binomial distribution. **Chi square Fisher test in inter-age group comparison. C = children; A = adolescents; NS = not significant.

Table 3. Cross-tabulation of screen time use and bedtime.

	Screen Time								
	Most of the Day			Half-Day			2-3 Hours		
	% (n)	χ^2	*P*	% (n)	χ^2	*P*	% (n)	χ^2	*P*
Children									
Bedtime delayed	36.1% (113/313)	1.384	0.239	33.5% (105/313)	4.304	0.038	24.6% (77/313)	7.757	0.005
Bedtime maintained	31.2% (67/215)			25.1% (54/215)			35.8% (77/215)		
Adolescents									
Bedtime delayed	56.2% (181/322)	16.433	0.0001	23.6% (76/322)	1.717	0.424	13% (42/322)	29.422	0.0001
Bedtime maintained	36.2% (50/138)			18.1% (25/138)			34.1% (47/138)		

Table 4. Cross-tabulation of screen time use and sleep duration.

|	Screen Time								
	Most of the Day			Half-Day			2-3 Hours		
	% (n)	χ^2	*P*	% (n)	χ^2	*P*	% (n)	χ^2	*P*
Children									
Duration increased	36.3% (41/113)	14.529	0.001	29.2% (33/113)	0.271	0.873	26.5% (30/113)	8.460	0.015
Duration maintained	28.4% (88/310)			31.0% (96/310)			33.5% (104/310)		
Duration decreased	48.6% (51/105)			28.6% (30/105)			19.0% (20/105)		
Adolescents									
Duration increased	53.5% (88/127)	15.934	0.0001	23.6% (30/127)	0.325	0.850	13.4% (17/127)	15.884	0.0001
Duration maintained	41.7% (98/235)			21.7% (51/235)			26.8% (63/235)		
Duration decreased	64.7% (66/102)			20.6% (21/102)			10.8% (11/102)		

Table 5. Comparison of sleep disturbances before-during lockdown in children and adolescents with ADHD and age groups comparison.

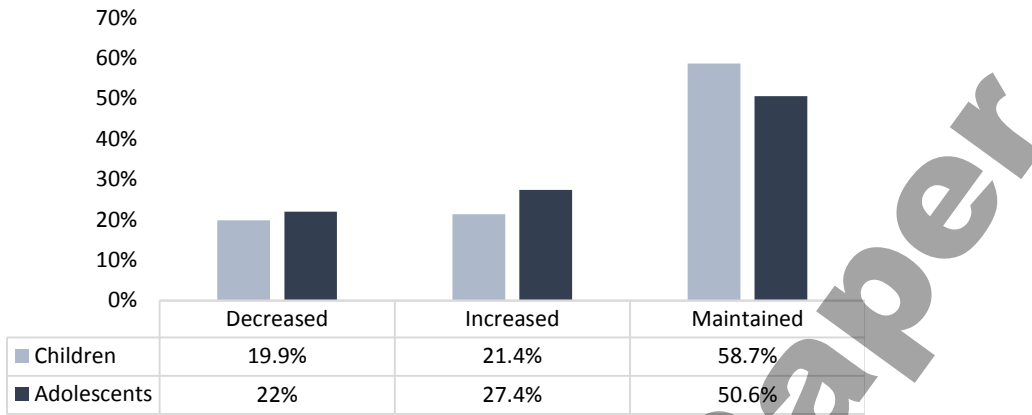|		**Before** n (%)	**During** n (%)	χ^2	*P* <	**C vs. A** χ^2	*P* <
Difficulty falling asleep	C	130 (24.6)	247 (46.8)	77.780	0.0001	0.005	NS
	A	152 (32.8)	216 (46.6)	24.951	0.0001		
Anxiety at bedtime	C	103 (19.5)	166 (31.4)	38.828	0.0001	34.334	0.0001
	A	56 (12.1)	72 (15.5)	5.114	0.024		
Hypnic jerks	C	80 (15.2)	97 (18.4)	4.830	0.028	3.807	0.051
	A	59 (12.7)	64 (13.8)	0.485	NS		
Rhythmic movements	C	33 (6.3)	42 (8.0)	-	0.078*	7.218	0.007
	A	13 (2.8)	18 (3.9)	-	NS*		
>2 awakenings/night	C	50 (9.5)	94 (17.8)	31.879	0.0001	3.310	NS
	A	36 (7.8)	63 (13.6)	13.796	0.0001		
Restless sleep	C	223 (42.2)	214 (40.5)	0.985	NS	2.584	NS
	A	160 (34.5)	165 (35.6)	0.254	NS		
Snoring/apnea	C	33 (6.3)	31 (5.9)	-	NS*	0.630	NS
	A	41 (8.8)	33 (7.1)	-	NS*		
Sleep walking	C	38 (7.2)	46 (8.7)	-	NS*	5.381	0.020
	A	29 (6.3)	23 (5)	-	NS*		
Sleep terrors	C	28 (5.3)	27 (5.1)	-	NS*	5.044	0.025
	A	10 (2.2)	11 (2.4)	-	NS*		
Bruxism	C	91 (17.2)	82 (15.5)	1.939	NS	10.932	0.001
	A	60 (12.9)	40 (8.6)	12.033	0.001		
Nightmares	C	80 (15.2)	132 (25)	27.094	0.0001	25.891	0.0001
	A	49 (10.6)	57 (12.3)	1.633	NS		
Daytime sleepiness	C	61 (11.6)	86 (16.3)	6.940	0.008	27.824	0.0001
	A	90 (19.4)	141 (30.4)	26.882	0.0001		

*Binomial distribution. C = children; A = adolescents; NS = not significant.
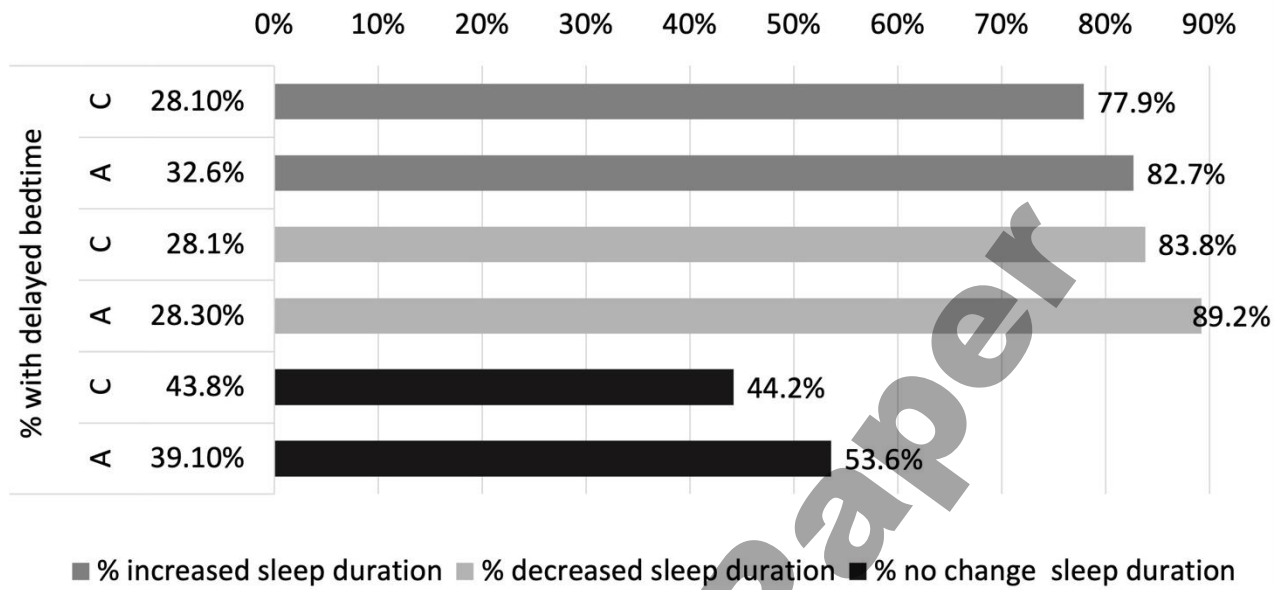
Figure 1. Bedtime changes during lockdown.

	Anticipated	Delayed	Maintained
Children	0%	59.3%	40.7%
Adolescents	0.9%	69.4%	29.7%
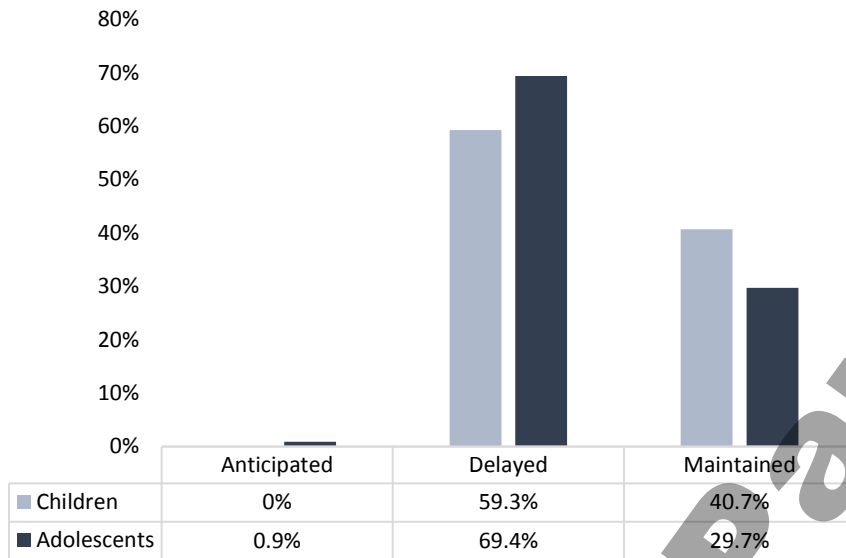
Figure 2. Sleep duration changes during lockdown.

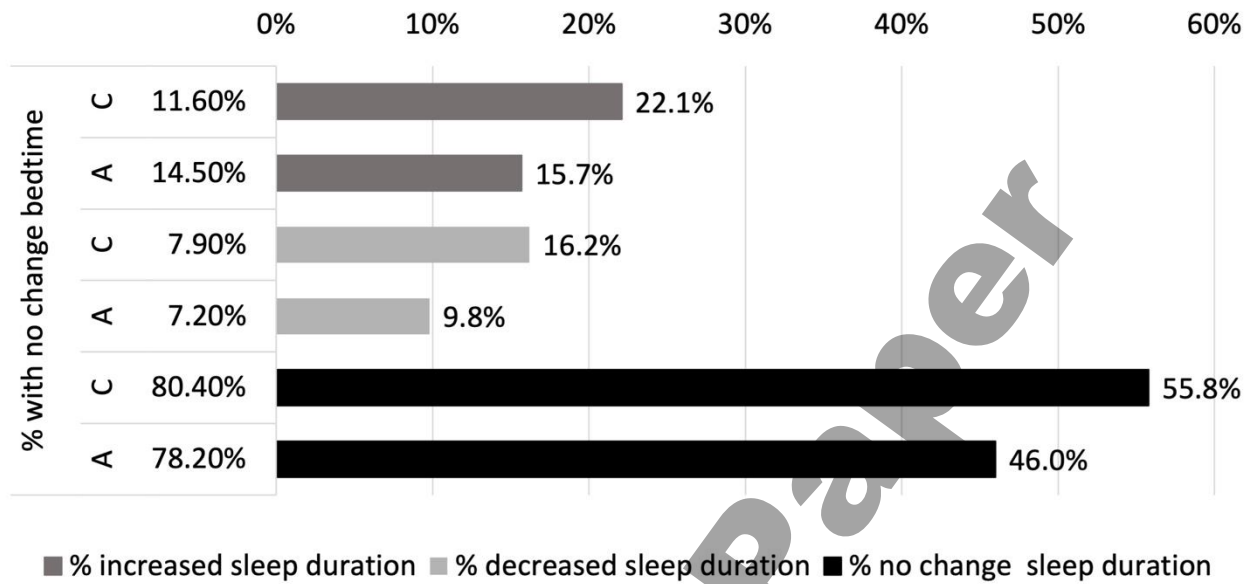|	Decreased	Increased	Maintained
Children	19.9%	21.4%	58.7%
Adolescents	22%	27.4%	50.6%

Figure 3. Cross-tabulation between bedtime delay and sleep duration.

C = children; A = adolescents.

Figure 4. Cross-tabulation between maintained bedtime and sleep duration.

C = children; A = adolescents.