Sleep and Psychological Difficulties in Italian School-Age Children During COVID-19 Lockdown

Nicola Cellini [1,2,3,4] PhD, **Elisa Di Giorgio,**[5] PhD, **Giovanna Mioni,**[1] and PhD, **and Daniela Di Riso,**[5] PhD

[1]Department of General Psychology, [2]Department of Biomedical Sciences, [3]Padova Neuroscience Center, , [4]Human Inspired Technology Center, and [5]Department of Developmental Psychology and Socialization, University of Padova

All correspondence concerning this article should be addressed to Nicola Cellini, PhD, Department of General Psychology, University of Padova, Via Venezia 8, 35131 Padova, Italy. E-mail: nicola.cellini@unipd.it

Abstract

Objective   On March 10, 2020, the Italian Government ordered a national lockdown to limit the viral transmission of coronavirus disease 2019 infections. This study investigated how these restrictive measures have impacted sleep quality, timing, and psychological difficulties in school-age children and their mothers during the lockdown. **Methods**   In an online survey, 299 mothers reported their sleep habits, experience of time, and psychological difficulties as well as those of their children (6–10 years old) during and, retrospectively, before the lockdown. **Results**   During the lockdown, children showed a marked delay in sleep timing—that is, later bedtime and rise time—and a mild worsening in sleep quality. They were less prone to respect daily routines or to keep track of the passage of time. They showed increased emotional, conduct, and hyperactive symptoms, and the increase in these psychological difficulties was predicted by the change in sleep quality, boredom, and mothers' psychological difficulties. In addition, mothers showed a delayed sleep timing and worsening of sleep quality during the lockdown, in varying degrees depending on their working conditions. Mothers who kept working regularly outside their homes during lockdown reported more regular sleep patterns, whereas mothers who stopped working showed more emotional symptoms and relevant changes in their perception of time. **Conclusions**   Overall, given the evidence of the adverse behavioral and psychological impact of home confinement and social restrictions, effective measures needed to be in place to mitigate long-term effects on children and their mothers, especially those who have had to stop working during lockdown.

Key words: behavior problems; health behavior; mental health; parent psychological functioning; public health; sleep.

Introduction

On March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus disease 2019 (COVID-19) outbreak a pandemic. In a more striking way than in other countries, on March 10, 2020, the Italian Government ordered a national lockdown to limit the viral transmission of COVID-19 infections. The lockdown included such measures as home confinement, restrictions on movement, encouragement to work from home by telecommuting, and temporary closure of nonessential businesses and schools of every order and degree.

Although necessary, prolonged home confinement may have detrimental effects on mental health, affecting people's lives by influencing their everyday behavior. Previous studies on quarantine situations (e.g., Sprang & Silman, 2013) have highlighted these effects. Most people have experienced unprecedented stressful conditions with increased psychological symptoms such as emotional dysregulation, depression, stress, and anxiety (Brooks et al., 2020), as well as effects on their sleep quality and circadian rhythms (Blume et al., 2020; Cellini et al., 2020; Wright et al., 2020). The link between sleep disturbances and behavioral (e.g., self-regulation, conduct, and attention) and emotional (depression, anxiety, and stress) difficulties has been well-established in adults, in adolescents, and even in children (Baum et al., 2014; Gregory & O'Connor, 2002; Paavonen et al., 2009). A few studies have already explored the interplay between sleep habits and psychosocial well-being during the COVID-19 outbreak in large samples of Italian adults (Casagrande et al., 2020; Cellini et al., 2020; Gualano et al., 2020). During the home confinement period, individuals have reported marked changes in sleep habits that is, later bed and rise times, increased time spent in bed, and poorer sleep quality. Unhealthy sleep pattern seemed to be associated with more intense symptoms of depression and anxiety (Cellini et al., 2020). Casagrande et al. (2020) indicated that females and people who reported fear to be infected by COVID-19 are more prone to sleep disturbances and to feeling distressed. Moreover, poorer sleep quality seemed to be associated with symptoms of posttraumatic stress disorder.

Although children are less likely to be severely infected by the virus, the COVID-19 pandemic might have a dramatic impact on younger individuals due to the disruption of daily routines (Brazendale et al., 2017; Jiao et al., 2020). They experience fears, uncertainties, physical and social isolation, and may miss school for a prolonged period. The literature highlights that even predictable school closures, such as holidays or weekends, might affect children's well-being in terms of unhealthy sleep patterns and poorer physical activity (Wang et al., 2020a). The pandemic outbreak, which imposes a prolonged and unexpected interruption on normal school routines, daily activities, and connections with peers, could represent an important risk factor for physical and mental health in children and families.

Rates of depression and anxiety in mothers might be exacerbated during the coronavirus outbreak due to unpredictable changes in family income and employment, as well as to a rapid reorganization of daily care for children in a context where social support is lacking (Brooks et al., 2020). In this scenario, the dyads of mothers and children share a significant transformation in their psychosocial functioning such as mandatory home confinement, interruption of in-person relationships, and an increase in forced interaction with family members (Cameron et al., 2020). Moreover, literature suggests that children are more likely to experience emotional or behavioral difficulties if at least one parent works on irregular schedules both in ordinary and in pandemic scenarios (Manzo & Minello, 2020; Rönkä et al., 2017). Also, the exposure of children to maternal psychological difficulties may lead to negative outcomes such as internalizing or externalizing symptoms, delays in development goals, and sleep problems (Zreik et al., 2020). This pattern may be more relevant for school-age children. Primary school children might be largely affected by school closures or suspension of outdoor activities due to the importance of interpersonal relationships and autonomous, extra-family experiences in this specific developmental stage (Golberstein et al., 2020). Moreover, children aged 6–10 seem to be more prone than preschool children to understanding the medical and psychological impact of the COVID-19 pandemic (Idoiaga et al., 2020). As a consequence, they may show emotional dysregulation due to intense worry about contagion or to the imposed social restrictions (Orgilés et al., 2020). Accordingly, a mother's emotional regulation could be a protective factor in scaffolding an eventual negative affective response in their children to the stressful and unpredictable context of the global pandemic (Romero et al., 2020). On the other hand, it seems that a mother's difficulties in emotional regulation and emotional awareness are associated with internalizing and externalizing problems in their children (Crespo et al., 2017).

Sleep seems to form a crucial link between physical and psychological wellbeing, especially in younger individuals (Becker & Gregory, 2020; Carskadon & Barker, 2020; Gregory & O'Connor, 2002). For instance, sleep duration in school-age children is negatively correlated with behavior and mood problems (Paavonen et al., 2009) and both sleep and timing modulate the children's abilities to adequately regulate emotions (Carskadon & Barker, 2020). Prolonged home confinement due to pandemic outbreaks may induce children to significantly postpone sleep and rise time, with an elongation of time spent in bed doing daily activities such as remote learning, studying, or playing (Guan et al., 2020). Moreover, children with irregular sleep patterns seemed to be more distressed, hyperactive, and inattentive, and to have lower tolerance for frustration (Jiao et al., 2020). Therefore, it is not surprising that the European Academy for Cognitive Behavioural Therapy for Insomnia, in their guidelines for dealing with sleep problems during home confinement (Altena et al., 2020), proposed specific recommendations for mothers and their children,

who are considered at high risk for developing sleep and mental problems during this unprecedented situation.

Although the literature on the effects of the restrictions related to COVID-19 on sleep habits in adults and preschoolers (<6 years old) is increasing rapidly (Blume et al., 2020; Casagrande et al., 2020; Cellini et al., 2020; Dellagiulia et al., 2020; Di Giorgio et al., 2020; Gualano et al., 2020; Kokou-Kpolou et al., 2020; Lin et al., 2020; Liu et al., 2020; Voitsidis et al., 2020; Wright et al., 2020), studies focusing on sleep patterns in school-age children during this pandemic are very scarce and mainly focus on sleep duration using samples with wide age ranges (e.g., 3–18 or 2–12 years old; Baptista et al., 2020; Orgilés et al., 2020; Pietrobelli et al., 2020; Tso et al., 2020).

To fill this gap in the literature, we aimed in this study (a) to investigate how prolonged home confinement during the national lockdown has impacted sleep in mothers and their school-age children in terms of timing and quality, and (b) to describe the interplay between children's sleep and changes in routine in predicting their emotional symptoms and difficulties. Specifically, we aimed to (a) describe changes in sleep timing and quality for both mother and child and their emotional functioning during home confinement compared with preconfinement; and (b) determine the relationship between changes in sleep and routine in children and the resulting emotional difficulties by also taking into account changes in their mothers' sleep and resulting emotional symptoms.

We expected to observe a shift in sleep timing (delayed bed and rise time) and a general decrement in sleep quality in children and their mothers. We also expected that the increase in psychological difficulties in children during lockdown would be associated with changes in children's sleep quality and timing and mothers' emotional difficulties.

Participants and Procedure

We collected data from 319 participants. Of this sample, we excluded nine male caregivers and 11 responders who had children older than 10 years. The final sample consisted of 299 mothers (M_{age} = 40.2 years, SD_{age} = 4.79, age-range = 22–54 years) and their children (M_{age} = 7.96 years, SD_{age} = 1.36, Females = 139). We collected data through an online survey implemented in Google Forms from April 1 to April 9, 2020. During this period, Italy was under a national lockdown, which included the closure of all schools and nonessential businesses. Moreover, people were not allowed to leave their homes unless for an essential reason, such as to buy food and medicine, emergencies, healthcare reasons, or verifiable work situations. Workers were forced, whenever possible, to work remotely from their homes.

All participants were at least 18 years old, were living in the Italian national territory, and had at least one child between 6 and 10 years of age. Participants were recruited through social media groups, online advertisements on research-related websites, and by word of mouth (the snowballing method). We shared a text with general information about the study and a link to the survey. In the first step of the survey, the respondents had to read a full description of the study and explicitly agree to participate through an online informed consent form. They then answered general questions concerning socio-demographic characteristics. We asked mothers to complete the survey by thinking about their own habits, behaviors, and emotions as well as those of their children. Importantly, questions referred to their experiences at present, during the quarantine (from April 1 to 9, after 3 weeks of confinement), and retrospectively to the week before the total lockdown (February 24–29). We asked mothers with more than one child to think about their youngest child. The survey took about 30 min to be completed, and participation was entirely voluntary, with no incentive (e.g., credit, money, voucher) for participation. Note that there were no missing data since data were saved only if participants completed the entire survey and confirmed at the end that they wanted to submit their responses. The project was approved by the local Ethical Committee (Prot. No. 3521).

Measures

Demographic Questions

The demographic section of the survey included questions regarding the age, gender of both the mother and the children. Moreover, we asked mothers to report their educational levels, employment status (i.e., working regularly, stopped working, not working, working from home), and the number of children. We also asked them to respond to a few questions related to their situation under COVID-19. In detail, we asked them: (a) how scared they felt about COVID-19 on a 4-point scale (0 = *not at all* to 3 = *very scared*); (b) where they obtained information about the novel coronavirus (multiple response options, including TV, online newspapers, general websites, social media); (c) whether they knew relatives, friends, or acquaintances infected by or deceased due to COVID-19 (yes/no answer).

Behavioral Factors

Sleep Pattern

The quality of the mother's sleep was assessed using the total score of the Pittsburgh Sleep Quality Index (PSQI; Italian version by Curcio et al., 2013), a valid, reliable, and widely used self-report questionnaire.

This 18-item scale ranges from 0 to 21, with higher scores indicating poorer sleep quality. A total score of > 5 indicates poor sleep quality. From items 1 and 3 of the same questionnaire, we extracted the average bedtime (the time they went to bed to sleep, hh: mm) and rise time (the time they woke up in the morning, hh: mm) of the mothers. We also derived the time spent in bed (hr) as the time between bedtime and rise time, and the sleep midpoint (hh: mm) as [(bedtime-rise time)/2]. Moreover, sleep midpoint is considered a good indicator of individual chronotype that is, the organism's temporal organization, including behaviors associated with sleep timing (Bauducco et al., 2020; Roenneberg et al., 2019). It also represents the interaction between an individual's sleep–wake patterns (i.e., sleep duration) and daily routines such as the time a person goes to bed and the time a person needs or wants to wake up (de Souza & Hidalgo, 2015). Indeed, an individual's chronotype depends on genetic and environmental factors, as well as on age, and can range from extreme early to extreme late (Roenneberg et al., 2004). Several studies have reported that later chronotype is associated with unhealthy behaviors and lower psychological well-being in both children, adolescents, and adults (Fabbian et al., 2016; Gariépy et al., 2019; Randler, 2016; Taylor & Hasler, 2018).

The quality of the children's sleep was assessed using the total score of the Sleep Disturbance Scale for Children (SDSC; Bruni et al., 1996). This questionnaire, validated for Italian children aged 6.5–15.3 years, consists of 26 items with a total score ranging from 26 to 130. Higher scores indicate greater sleep difficulties. A score > 39 can be considered a cutoff for identifying children with potentially disturbed sleep. Also, we asked the mothers to report the average bedtime and rise time of their children, and we again derived the time spent in bed and the sleep midpoint.

Both the PSQI and the SDSC were completed twice, with one completion focusing on the current state and the second completion focusing retrospectively on the preconfinement period.

Time Perception
To assess the mothers' subjective feelings of time, we adapted seven items from the Subjective Time Questionnaire (Italian version by Mioni et al., 2020). The questionnaire contains several parts consisting of questions concerning everyday experiences and a retrospective look at long past-time intervals as well as subjective feelings and metaphors of time. In relation to this study, we asked how quickly one hour, one day, and one week has passed. For all the item, we asked participants to think to the first week of February and the most recent past week. Responses ranged from 1 = *very slow* to 5 = *very fast*. We also

used questions with statements referring to the feeling of time pressure or time compression (two statements, e.g., "I often think that time is running out.") and to the feeling of time expansion or time affluence (two statements, e.g., "My time is not filled."; anchors: 1 = *strong rejection* and 5 = *strong approval*).

For children, we used three items to test the subjective feeling of time and time management. Two out of three items were selected from Porcelli et al. (2018): "He/she does not experience that time has passed" and "He/she doesn't respect the routine." The third item investigates children's subjective perceptions of boredom, which are strongly correlated with time (Zakay, 2014): "Is he/she experiencing boredom?"

The items related to time perception in both parents and children were completed twice, with the first completion focusing on the current state and the second completion focusing retrospectively on preconfinement.

Psychological Factors
The Strengths and Difficulties Questionnaire–Parent Version
The Strengths and Difficulties Questionnaire–Parent version (SDQ-P; Italian version validated by Tobia and Marzocchi, 2018) is a parent-report screening tool aimed to evaluate children's strengths and difficulties as detected by their parents. The SDQ-P includes 25 items developed on a 3-point Likert scale (0 = *Not true*; 1 = *Somewhat true*; 2 = *Certainly true*). The questionnaire is characterized by five subscales: emotional symptoms (EMO, five items), peer problems (PEER, five items), hyperactivity-inattention (HYPER, five items), conduct problems (COND, five items), and prosocial behaviors (PROS, five items), and a Total Difficulty Score. We collected data only on the EMO, HYPER, and COND subscales and computed the Psychological Difficulty Score (PDS) as the sum of the scores on these three subscales. Moreover, from the raw score in each of the subscales, we calculated the proportion of children at high risk of developing clinical symptoms taking into account their ages and genders (Tobia & Marzocchi, 2018).

The Strengths and Difficulties Questionnaire—18+
The Strengths and Difficulties Questionnaire—18+ (SDQ 18+) Goodman, 1997), a screening self-report questionnaire for individuals older than 18 years, was used to assess the parents' strengths and difficulties. SDQ 18+ presents the same structure as the parent's version. Similar to the procedure we used for the children, we collected data only on the EMO, HYPER, and COND subscales, and computed the PDS 18+.

Both the SDQ and SDQ 18+ were completed twice with one completion focusing on the current state and

the second completion focusing retrospectively on preconfinement.

The Difficulties in Emotion Regulation

We used the difficulties in emotion regulation (DERS; Italian version validated by Giromini et al., 2012), a 36-item questionnaire, to detect multiple features of the parents' emotion regulation. For each question, parents had to respond on a 5-point Likert scale (from $1 = almost\ never$ to $5 = almost\ always$). The total score of the DERS was used in this study. The DERS was completed only once, focusing on the current situation because it is considered a trait-based measure of emotion dysregulation.

Statistical Analysis

We conducted a series of linear mixed models (LMMs) to describe the following factors: changes in children's sleep timing (i.e., bedtime and rise time), duration, and quality (i.e., PSQI total score); their emotional functioning (i.e., EMO, HYPER, COND, and PDS); and their experience of time experience during home confinement compared with preconfinement. In these models, participants were included as a random factor. The following were fixed effects: mothers' work conditions (Work: working regularly, working from home, stopped working, and not working); time of the assessment (Lockdown: before home confinement, during home confinement); and the gender of the children. There were two covariates: the mothers' total scores on the DERS and the age of the children. We used the Holm method to correct post-hoc comparisons.

We used the same models to analyze the responses from the mothers, describing changes in sleep timing, sleep quality, emotional symptoms, and time perception. Again, participants were included as a random factor. The conditions of work and lockdown were fixed effects. Covariates included the mothers' total scores on the DERS and their age.

We used McNemar's test to assess the change in the proportion of children and mothers with sleep difficulties (SDSC > 39 and PSQI > 5, respectively) before and during home confinement.

Next, to determine the potential predictors of psychological difficulties in children while taking into account changes in their sleep and routine and their mothers' emotional symptoms, we built a multiple linear regression model with the change in children's PDS (ΔPDS) as the dependent variable and the following as covariates: changes in children' sleep quality (ΔSDSC) and timing (using the change in sleep midpoint, which takes into account the changes in bedtime and rise time); changes in the children level of boredom; children's age; mothers' fear of the COVID-19 contagion; and changes in the mothers'

psychological difficulties (i.e., the ΔPDS 18+). For the regression model, we reported the fit of the model (Analysis of variance test), the adjusted R^2, the regression coefficient (b), and the standardized beta (std. β) of each predictor. Standardized β is interpreted as the standard deviation change in the children's ΔPDS per 1-standard deviation increase in the predictor variable, controlling for the other variables in the model.

For all the analyses, the level of significance was set at $p < .05$.

Results

Descriptive Statistics

An a posteriori analysis (after ending data collection) of the age of the children showed that age was equally distributed between 6 and 10 years ($\chi^2_4 = 5.90$, $p = .207$). Moreover, the sample had a similar proportion of females (46.5%) and males (46.5%, $\chi^2_2 = 1.47$, $p = .225$). All the children went to school before the restrictions. All but one child was informed by the family about the COVID-19 situation using different modalities, mainly by video (58.9%) and through scientific information (45.8%). For the younger (6–7 years, $N = 122$), the COVID-19 situation was also explained using specifically created fairy-tales (35% of this sample). Before the lockdown, 31 children (10.5%) underwent psychological treatment, whereas during the lockdown the number of children followed by a psychologist was 34 (11.3%; 4 new children, with 1 child ending clinical treatment).

Most of the mothers (74.3%) were in the age range of 35–45 years. The majority of them ($N = 239$, 79.9%) worked before the lockdown. During the lockdown, only 19.7% of them continued working outside their homes, whereas 47.7% had to start working from home in a remote modality, and 32.7% had to stop working. Mothers had a relatively high fear of contagion (17.7% reported a high level of fear, and 47.5% a moderate fear), 28.7% of them knew someone who had contracted COVID-19, and 8.7% knew someone who had passed away due to the contagion (Table I).

Impact of Home Confinement on Children

The LMM for children's bedtime showed that lockdown had a significant effect ($F_{1,\ 291} = 651.87$, $p < .001$, Figure 1a), regardless of the mothers' work conditions, and a significant covariation with age ($F_{1,\ 289} = 17.48$, $p < .001$), with older children who went to bed later during lockdown (coefficient $= 0.14$, SE $= 0.03$, $t = 4.18$). In general, children went to bed 1 hr and 18 min later than before the lockdown (Table II). Also, rise time significantly changed during lockdown ($F_{1,\ 291} = 663.48$, $p < .001$, Figure 1b), with children waking up 1 hr and 50 min later than before

Table I. *Demographics and Descriptive Information About Mothers and Their Children for Each Working Condition*

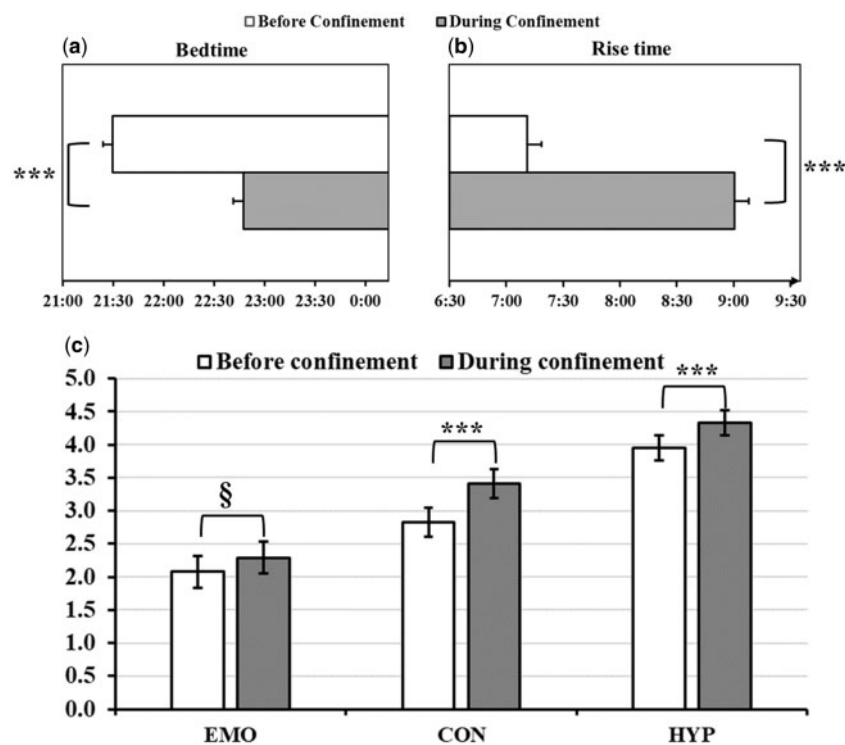| Mothers	Mean (SD)
Age (years)	40.02 (4.79)
Number of children in the family	2.0 (0.7)
Area of Italy	N (%)
North	231 (78%)
Center	11 (3.7%)
South	54 (18.2%)
COVID-19 items	
Do you fear getting infected (0–3)?	1.80 (0.76)
Do you know someone who has tested positive for COVID-19?	N (%)
Infected	86 (28.8%)
Deceased	26 (8.7%)
Children	Mean (SD)
Age (years)	7.96 (1.36)
	N (%)
Gender (M)	160 (53.5)

Figure 1. Changes in children's (a) bedtime (b) rise time as a function of the presence of the home confinements. (c) Changes in children's Strengths and Difficulties Questionnaire subscales as a function of the presence of the home confinements. EMO = Emotional symptoms subscale; CON = Conduct problems subscale; HYP = Hyperactivity/inattention subscale. Error bars represent the standard error of the mean. ***$p < .001$, §$p = .051$.

lockdown. Overall, the sleep midpoint shifted by 1 hr and 36 min.

Lockdown also had a significant effect on time in bed ($F_{1, 291} = 68.83$, $p < .001$), with children spending about 27 min more in bed. Specifically, during lockdown children spent about 10 hr 12.6 min in bed, whereas before home confinement, they spent 9 hr 44 min in bed (Table II). We also observed a significant interaction of Work × Lockdown ($F_{3, 289} = 3.44$, $p = .017$), showing that children whose mothers started working from home or had to stop working

spent more time in bed (p's $< .001$), whereas no significant difference was observed for children whose mothers were not working ($p = .405$) or continued working as before the lockdown ($p = .165$; see Supplementary Table S2 for estimated means). We also observed a significant effect by age ($F_{1, 289} = 20.84$, $p < .001$; coefficient $= -0.149$, SE $= 0.03$, $t = -4.57$), with younger children spending more time in bed during the lockdown.

Lockdown showed a significant effect on sleep quality, as well ($F_{1, 291} = 4.93$, $p = .027$, Table II),

Table II. *Estimated Marginal Means of Fitted Models for the Main Variables of the Study in Children and Mothers Before and During Home Confinement*

	Before home confinement	During home confinement
Children	Mean (SE)	Mean (SE)
Sleep variables		
Bedtime (hh: mm)	21:30 (0:03)	22:48 (0:03)
Rise time (hh: mm)	07:11 (0:04)	09:01 (0:04)
Time in bed (hr)	9.73 (0.05)	10.21 (0.05)
Sleep midpoint (hh: mm)	02:18 (0:03)	03:54 (0:03)
SDSC total score	38.6 (0.58)	39.9 (0.58)
Strengths and difficulties		
EMO	2.08 (0.12)	2.29 (0.12)
COND	2.83 (0.11)	3.41 (0.11)
HYP	3.95 (0.10)	4.33 (0.10)
PDS	8.86 (0.25)	10.02 (0.25)
Time variables		
Time flow	1.17 (0.06)	1.30 (0.06)
Routine	0.50 (0.05)	1.16 (0.05)
Boredom	0.80 (0.05)	1.35 (0.05)
Mothers		
Sleep variables		
Bedtime (hh: mm)	22:42 (0:04)	23:48 (0:04)
Risetime (hh: mm)	6:45 (0:04)	8:00 (0:04)
Time in bed (hr)	8.02 (0.07)	8.24 (0.07)
Sleep midpoint (hh: mm)	02:42 (0:03)	03:54 (0:03)
PSQI total score	3.73 (0.16)	5.66 (0.16)
Strengths and difficulties		
EMO	3.22 (0.13)	3.59 (0.13)
COND	1.97 (0.08)	2.01 (0.08)
HYP	4.35 (0.10)	4.56 (0.10)
PDS	9.54 (0.24)	10.16 (0.24)
Time variables		
Speed of a hour	3.67 (0.06)	3.13 (0.06)
Speed of a day	3.68 (0.06)	3.16 (0.06)
Speed of a week	3.83 (0.06)	3.30 (0.06)
Time pressure	2.80 (0.05)	2.07 (0.05)
Time expansion	2.09 (0.05)	2.67 (0.05)

Note. SDSC = Sleep Disturbance Scale for Children; EMO = Emotional Symptoms; COND = conduct problems; HYP = hyperactivity-inattention; PSQI = Pittsburgh Sleep Quality Index. Variables showing a significant change across time are highlighted in bold. Note that mean ± SD of the main study variables without controlling for age, gender, work condition, and participants' random effect can be found in Supplementary Table S1.

regardless of the mothers' working conditions ($F_{3, 291}$ = 0.34, $p = .795$). We observed a significant interaction of the Gender × Lockdown ($F_{1, 291} = 4.38$, $p = .037$), showing that poorer sleep was being experienced by females ($p = .022$) more than by males ($p > .99$). Age was not a significant covariate, but the total score on the DERS did covariate positively with the change in sleep quality ($F_{1, 289} = 38.52$, $p < .001$; *coefficient* = 1.69, SE = 1.01, $t = 6.21$). The proportion of children with potentially disturbed sleep (i.e., SDSC > 39) did not increase significantly during home confinement (39.5–41.1%; $\chi^2_1 = 0.37$, $p = .541$).

Emotional symptoms showed a trend for worsening during lockdown ($F_{1, 291} = 3.84$, $p = .051$, Figure 1c), and again the mothers' total score on the DERS covaried positively with their children's emotional symptoms ($F_{1, 289} = 14.29$, $p < .001$; coefficient = 0.02, SE = 0.005, $t = 3.78$). During lockdown, conduct problems increased significantly ($F_{1, 291} = 28.17$, $p < .001$,

Figure 1c), and the total score on the DERS resulted in a significant covariate ($F_{1, 289} = 14.68$, $p < .001$; coefficient = 0.02, SE = 0.005, $t = 3.83$). Hyperactivity-inattention symptoms also increased during the lockdown ($F_{1, 291} = 16.31$, $p < .001$, Figure 1c), and, in general, was higher in males than in females ($F_{1, 291} = 7.53$, $p = .006$), although the interaction Gender × Lockdown was not significant ($F_{1, 291} = 0.71$, $p = .402$). Again, the total score on the DERS was a significant covariate ($F_{1, 289} = 8.10$, $p = .005$; coefficient = 0.01, SE = 0.004, $t = 2.85$). Last, the PSD 18+ score showed an increase during home confinement compared with the period before ($F_{1, 291} = 24.74$, $p < .001$), and the total score on the DERS resulted in a significant covariate ($F_{1, 289} = 22.10$, $p < .001$; coefficient = 0.05, SE = 0.01, $t = 4.70$). No other effect was observed (all p's > .103).

Regarding time experience, children had more difficulty keeping track of the passage of time during
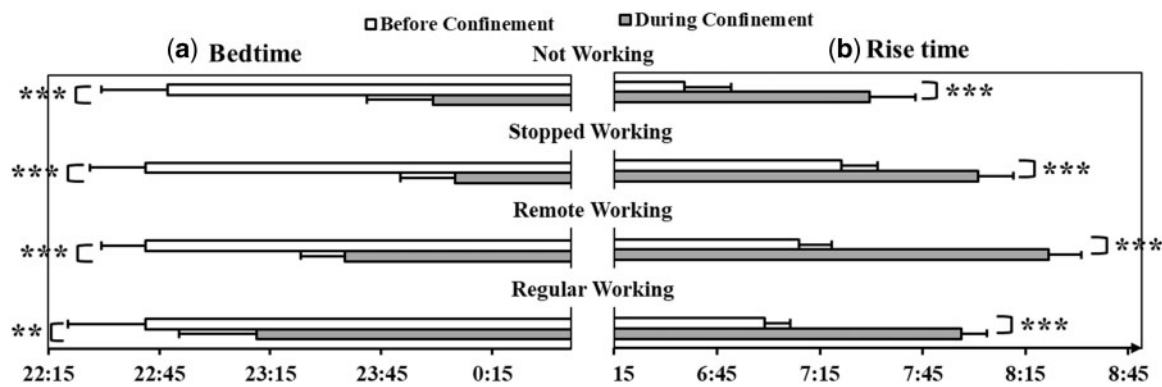
Figure 2. Changes in mothers' (a) bedtimes, (b) rise times, as a function of the presence of home confinement and the mothers' working conditions. Error bars represent the standard error of the mean.

home confinement ($F_{1, 291} = 3.80$, $p = .011$), and they were less able to attend to daily routines ($F_{1, 291} = 133.53$, $p < .001$) compared with the period before lockdown. As expected, children felt more bored ($F_{1, 291} = 99.11$, $p < .001$), and this effect was stronger in males than in females (Gender × Lockdown: $F_{1, 291} = 6.11$, $p = .014$). We also observed a significant Gender × Lockdown × Work interaction ($F_{1, 291} = 99.11$, $p < .001$), showing an increased feeling of boredom in all children during home confinement compared with the period before the lockdown (all p's < .023), except for females with mothers who were not working or who continued working regularly ($p = .99$).

Impact of Home Confinement on Mothers

The LMM from mothers' bedtimes showed a significant effect from Lockdown ($F_{1, 295} = 253.08$, $p < .001$, Table II), and a significant interaction of Work × Lockdown ($F_{3, 293} = 7.31$, $p < .001$), with mothers who had stopped working going to bed 1 hr 24 min later ($p < .001$), those who did not work 1 hr and 12 min later ($p < .001$), and those who started working from home 54 min later ($p < .001$). Mothers who continued working regularly outside home went to bed 36 min later ($p = .003$, Supplementary Table S3). For rise time, we observed only a significant effect from the Lockdown variable ($F_{1, 295} = 284.34$, $p < .001$, Table II), and a main effect from Work ($F_{1, 293} = 3.86$, $p = .010$), but not a significant interaction of the Work × Lockdown ($F_{3, 295} = 1.50$, $p = .215$, Figure 2a), although we observed some nominal differences: mothers who had stopped working woke up 1 hr 17 min later, whereas those who did not work woke up 1 hr 27 min later, and those who had started working at home 1 hr 16 min later. Those who continued working regularly outside their homes woke up 59 min later (Figure 2b and Supplementary Table S3). Also, the total score on DERS resulted in significant covariates ($F_{1, 293} = 4.70$, $p = .031$, coefficient =

0.006, SE = 0.003, $t = 2.17$). Overall, the sleep midpoint shifted by 1 hr 10 min.

The analysis on the mothers' time in bed showed only a significant effect from lockdown ($F_{1, 295} = 6.77$, $p = .010$, Table II), with an average increase in time in bed of 13.2 min. Work and the Work × Lockdown interaction were not significant ($F_{3, 293} = 0.06$, $p = .981$, and $F_{3, 295} = 0.30$, $p = .296$, respectively).

Sleep quality decreased during the lockdown ($F_{1, 295} = 101.42$, $p < .001$, Table II), regardless of the mothers' working conditions ($F_{1, 295} = 0.76$, $p = .517$; Supplementary Table S3); the DERS total score covariated positively with the change in sleep quality ($F_{1, 293} = 35.16$, $p < .001$; coefficient = 0.04, SE = 0.007, $t = 5.93$) and the proportion of mothers with poor sleep (i.e., PSQI > 5) significantly increased from 19.7% to 45.8%, ($\chi^2_1 = 53.4$, $p < .001$).

Emotional symptoms showed an increase during home confinement compared with the period before ($F_{1, 295} = 8.72$, $p = .003$, Table II). Although we observed a main effect of Work ($F_{3, 293} = 3.31$, $p = .021$), with higher emotional symptomatology in mothers who stopped working compared with those working from home, there was no significant interaction of Work × Lockdown ($F_{3, 295} = 0.58$, $p = .629$). The DERS total score did covariate positively with the change in emotional symptoms ($F_{1, 293} = 110.98$, $p < .001$; coefficient = 0.06, SE = 0.001, $t = 10.53$). Also, the hyperactivity-inattention symptoms increased during the lockdown ($F_{1, 295} = 3.92$, $p = .048$), and the DERS total score covariated positively with thus changed ($F_{1, 293} = 37.35$, $p < .001$; coefficient = 0.03, SE = 0.001, $t = 6.11$). No other significant effect was observed (all p's > .135). There was no significant interaction of the Work × Lockdown ($F_{3, 295} = 0.31$, $p = .817$). No significant change was observed for COND (all p's > .267). Last, PSD 18+ scores showed an increase during home confinement compared with the period before ($F_{1, 295} = 7.34$, $p = .008$), and a main effect of Work ($F_{3, 293} = 2.74$, $p = .043$), with

Table III. *Multiple Regressions of Changes in the Psychological Difficulties Score (PDS) in Children*

	δ Children psychological difficulties score			
	b (95% CI)	Std. β	t	p
Intercept	0.31 (−2.10, 2.72)	0	0.25	.802
Children age	−0.13 (−0.40, 0.13)	−0.05	−0.96	.338
Δ Children sleep quality	**0.14 (0.10, 0.18)**	**0.34**	**6.87**	**<.001**
ΔChildren sleep timing	0.20 (−0.21, 0.06)	0.05	0.96	.337
ΔChildren boredom	**0.94 (0.53, 1.35)**	**0.23**	**4.53**	**<.001**
Mothers' ΔPDS 18+	**0.23 (0.13, 0.33)**	**0.23**	**4.67**	**<.001**
Mothers' fear of COVID-19	0.39 (−0.08, 0.87)	0.07	1.62	.106
Model fit		$F(6, 292) = 23.1$ $p < .001$		
Adjusted R^2		0.308		

Note. b = unstandardized beta; std. β = standardized beta; CI = confidence intervals. Δ Children Sleep Quality = change in Sleep Disturbance Scale for Children (SDSC). Δ Children Sleep Timing = change in children sleep midpoint (which is derived from bedtime and rise time). Mothers ΔPDS 18+ = Psychological Difficulties Score in mothers. Significant predictors are highlighted in bold.

higher psychological difficulties in mothers who stopped working compared with those working from home ($p = .034$). The DERS total score covariated positively with the change in psychological difficulties ($F_{1, 293} = 130.80$, $p < .001$; coefficient = 0.12, SE = 0.011, $t = 11.44$).

Regarding time experience, mothers reported that their perceptions of the speed of hours ($F_{1, 295} = 42.84$, $p < .001$), days ($F_{1, 295} = 46.06$, $p < .001$), and the week ($F_{1, 295} = 45.51$, $p < .001$) were slowing down during home confinement (Table II). Interestingly, for both the speed of hours and the week, we observed a stronger effect in mothers who had started to work from home and in those who had stopped working (all p's $< .001$; Supplementary Table S3). They also felt a marked decrease in time pressure ($F_{1, 295} = 145.31$, $p < .001$), and an increase in time expansion ($F_{1, 295} = 99.20$, $p < .001$) during the confinement period.

Predictors of Children's Emotional Symptoms

The multiple regression models (Table III) showed that the change in children's emotional symptoms and difficulties was predicted by their sleep quality (i.e., worse sleep quality, worse emotional difficulties), their increasing boredom, and the mothers' emotional symptoms and difficulties. Interestingly, the change in sleep timing, age of the children, and mothers' fear of COVID-19 were not significant predictors of the change in children's psychological difficulties. Also, note that testing other models, including other COVID-19-related variables (e.g., knowing someone who was infected or died as a consequence of COVID-19), did not improve the presented model.

Discussion

In this study, we aimed to evaluate the effect of prolonged home confinement during the Italian lockdown in school-age children as well as in their mothers in terms of daily routines, sleep quality, and timing. In line with our initial expectations, we observed significant changes in children's sleep habits during home confinement, with later bedtimes and rise times, especially in older children. Moreover, children were less prone to respect the daily routines and to keep track of the passage of time. We also observe increased emotional, conduct, and hyperactive symptoms in children and the increase in these psychological difficulties was associated with the change in children's sleep quality, children's boredom, and mothers' psychological difficulties.

These results are in line with a previous study of Italian preschoolers by our group (Di Giorgio et al., 2020), where children who were 2–5 years old showed delayed sleep timing (i.e., later bedtimes and rise times). Interestingly, the bedtime delay in Italian preschoolers (53 min) was similar to that reported in a recent study in China (30–57 min; Liu et al., 2020), and it was reduced compared with the current sample of school-age children (1 hr and 18 min). It is possible that the marked delay in school-age children may be the consequence of the more extensive use of electronic devices in this age group, which Tso et al. (2020) observed. Another possibility has to do with the later-timed chronotype that occurs in people in this age group and continues during adolescence (Kuula et al., 2018; Werner et al., 2009).

Our results also showed that during home confinement, children spent more time in bed, likely because they did not have to wake up early to go to school. This effect was more pronounced in children whose mothers stopped working or those who started to work from home. These mothers were the ones who had more marked changes in their daily rhythms because they were not allowed to go work outside of their homes. These marked changes may have been

reflected in the time that their children spent in bed. The data on time in bed are in line with Tso et al. (2020), as well as Liu et al. (2020), showing a significant increase in the time spent in bed during the lockdown. However, the children in our sample seemed to spend more time in bed compared with the children in Orgilés et al. (2020) and Pietrobelli et al. (2020). The different assessment tools used, as well as the large age ranges of these two studies, may explain these differences.

Interestingly, although children showed a mild worsening of sleep quality during home confinement, the rate of potential disturbed sleep did not increase significantly as observed in Italian and Chinese preschoolers (Dellagiulia et al., 2020; Di Giorgio et al., 2020; Liu et al., 2020). Later sleep timing may have attenuated the potential risk for incurring poor sleep due to home confinement, as this is more aligned with the biological clocks of older/prepubertal children (Carskadon & Barker, 2020).

Interestingly, the small change in children's sleep quality was associated with their mothers' difficulties with emotional regulation. These results can be interpreted in line with the idea that in mothers, emotional weaknesses, such as depressive symptoms and stress, are often associated with sleep difficulties in children (Stoléru et al., 1997). It is also possible that mothers with poor emotional regulation tend to identify their children as more problematic and symptomatic (Zreik et al., 2020).

We also observed increased psychological difficulties in school-age children. Again, this result is in line with the data we reported for Italian preschoolers, where we observed increased emotional symptoms as well as conduct and hyperactivity/inattention problems during the lockdown (Di Giorgio et al., 2020). However, our data are only partially in line with the findings of Tso et al. (2020), who showed a general increase in psychosocial problems (measured by the SDQ total difficulties score) in children aged 2–12 years old during the pandemic period, although this effect was less pronounced in the group of children aged 6–12 years. Also, these results are partially consistent with Romero et al. (2020), who showed increased conduct, emotional, and hyperactivity problems in 27–40% of a Spanish sample (of children aged 3–12 years). These psychological difficulties during the lockdown suggest that Italian school-age children are at risk of developing internalized symptoms, such as sadness or concern, and externalized symptoms, such as irritability or difficulty with concentrating. The increase in psychological difficulties is also in line with a few reports showing that restrictions on mobility stemming from the novel coronavirus outbreak negatively impacted children's daily routines and psychological wellbeing (anxiety and frustration),

and caused boredom, mainly connected to unexpected and prolonged school closure (Jiao et al., 2020; Tso et al., 2020). Indeed, home confinement and school closure resulted in the interruption of in-person relationships with peers, as well as the reduction of personal space at home (Wang et al., 2020b).

Also, in mothers, we observed significant bedtime and rise time postponement, a worsening of sleep quality during the lockdown, and an increment of psychological symptoms, consistent with other recent papers on Italian adults (Casagrande et al., 2020; Cellini et al., 2020, 2021; Franceschini et al., 2020; Gualano et al., 2020; Salfi et al., 2020) as well as other adult samples from several countries (Beck et al., 2020; Blume et al., 2020; Lee et al., 2020; Lin et al., 2020; Voitsidis et al., 2020; Wright et al., 2020). These studies also highlighted that sleep difficulties were predominant in women. This finding may be explained by the already higher prevalence of insomnia in this population before the COVID-19 emergency (Altena et al., 2020), by the "gender gap" in childcare and eldercare (Brenna & Di Novi, 2016; Craig & Mullan, 2011), and by the wage gap (Boll & Lagemann, 2018).

Furthermore, mothers' working conditions seem to play a role in disrupting their healthy habits in a pandemic scenario, or helping them to maintain these habits. This is consistent with previous data showing that changes in work conditions during the COVID-19 emergency affected sleep patterns (Conroy et al., 2020; Di Giorgio et al., 2020; Staller & Randler, 2020). Although mothers who kept working regularly outside of their homes during the lockdown reported more regular sleep patterns, mothers who stopped working showed more emotional symptoms and relevant changes in their time perception. In this latter group, it is likely that the abrupt changes in daily routines—with no more regular schedules to follow, and with the temporary loss of their role as working women—negatively impacted their psychological wellbeing. Moreover, having to stop working is considered to be a major stressor. This is because it is generally associated not only with financial loss and economic distress on top of the gender wage gap, but also with lower self-esteem, anxiety, and depressive symptoms (see Brand, 2015). In this pandemic scenario, which was characterized by several unprecedented stressors (e.g., school closure, mobility restriction, fear of contagion), we can speculate that having to stop working may have had an even greater negative effect on individuals' wellbeing.

A second aim of this study was to determine the relationship between child sleep and routine changes, as well as their psychological difficulties, taking into account the mothers' emotional symptoms. We observed that a worsening of emotional symptoms in school-

age children during the lockdown was associated with changes in their daily habits (e.g., sleep quality), restrictions that the pandemic imposed (e.g., boredom), and the level of their mothers' psychological distress. Although sleep quality in children changed mildly from prelockdown to home confinement, this small change in sleep quality was predictive of the increase in their psychological difficulties, in line with the idea that poor sleep can "*set the stage for behavioral dysregulation and risks for psychopathology*" (Carskadon & Barker, 2020, p. 2). Interestingly, in contrast to Tso et al. (2020), who showed that delayed bedtimes and inadequate sleep during home confinement were associated with behavioral and emotional problems, as well as with parental stress, we did not find an association between sleep timing and psychological difficulties in children. However, it should be noted that here, we used a change in the sleep midpoint as a measure of sleep timing, whereas Tso et al. (2020) used a change in the bedtime in their analysis. Moreover, our analysis differs from Tso et al. (2020) with regard to several variables. Nevertheless, the findings from both studies suggest that changes in sleep patterns during the lockdown can affect psychological difficulties in school-age children. Of note, we speculate that the marked later midpoint of sleep during the lockdown in children (1 hr and 36 min) coupled with the small change in sleep quality may indicate a strong social jet lag (i.e., the discrepancy between social and biological time; Roenneberg et al., 2019) in Italian school-age children. Paradoxically, the home confinement may have helped school-age children to align their social and biological time, attenuating the negative impact of other lockdown-related factors on their sleep quality (e.g., children and mothers' psychological distress, boredom).

Our data should be interpreted in light of some limitations. First, the current study is cross-sectional, and data on children were collected only from mothers' reports. Although the literature supports this method, the distressing scenario in which mothers were involved might have affected their perceptions of their children's wellbeing. Also, the modest sample size and recruitment biases did not allow for the generalization of the results. The online survey could reach only mothers who were able to use electronic devices, but in times of social distancing, online recruitment represented the only way of accessing them. Furthermore, no information about family support for mothers (e.g., partner, grandparents), which could have mitigated the impact of quarantine burden, was collected. Second, the present research study employed retrospective questions to compare the present situation with the previous baseline before the lockdown. Although this method has some pitfalls and biases, it could be deemed reliable (Hipp et al., 2020). Third,

our sleep measures were self-reported. More objective measurements related to sleep (e.g., using polysomnography, actigraphy, or other wearable sleep trackers) would have allowed for more confident generalizations of our data. Indeed, a recent study with adults using a wearable device during mobility restriction in Singapore (Ong et al., 2020) showed a later shift in sleep timing but a minimal reduction of sleep quality (defined as the ratio between the time in bed and the actual time asleep).

Overall, given the evidence of the adverse behavioral and psychological impacts of home confinement and social restrictions, effective measures need to be in place to mitigate their long-term effects on children and their mothers, especially those who had to stop working. First, managing sleep problems as best as possible during home confinement can limit stress and possibly prevent behavioral and emotional problems (Altena et al., 2020; Crew et al., 2020). For example, the European Academy for Cognitive Behavioural Therapy for Insomnia (Altena et al., 2020) published several recommendations for women and children in the family context. For instance, families should try, when possible, to balance childcare between partners; maintain regular sleep timing for children and parents; reduce the use of electronic devices close to bedtime, and avoid their use in bed; and expose children to morning daylight and to organized physical activities. Second, based on this study as well as other studies in the literature, governments should implement both prevention and intervention programs for increasing psychological wellbeing in children and their caregivers in the event of a new COVID-19 wave or other epidemic situations. In Italy, public and private entities in April 2020 activated services to provide psychological support to the general population, along with specific therapeutic and social support for families in some cases. However, we think that governments should invest more in advertising and facilitate access to these services. Specific projects for sustaining mothers in handling their children's needs at the organizational (e.g., childcare when parents are at work), psychological (e.g., psychotherapeutic interventions and psychoeducation), and financial levels are urgently warranted. Finally, policymakers should implement modeling and observational studies to guide the opening of schools once the pandemic is under control.

Supplementary Data

Supplementary data can be found at: https://academic.oup.com/jpepsy.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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