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Quality of infant sleep, electronic devices and bullying behaviors in schools

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Abstract

Problem Statement:

This research investigates the relationship between the quality of infant sleep, the use of electronic devices and of videogames before bedtime and bullying behaviors in school context.

Research Questions:

Is the quality of infant sleep and the use of electronic devices at bedtime related to bullying?

The use of electronic devices before bedtime affects sleep duration and latency?

Purpose of the Study:

To analyze the relationship between the use of electronic devices before bed and the sleep infant quality. As well as, the relation between the quality of the children sleep duration, children' sleep latency, use of electronic devices, videogames in a daily basis, and bullying behaviors in school context.

Research Methods:

Participants are divided into two groups; one of these groups consists of the children who responded to the Pittsburgh Sleep Quality Index and the Children's Sleep Habits Questionnaire (CSHQ-



PT), totalling 860. The other group had a sample of 51 children, the Sociodemographic Questionnaire and the Children's Sleep Habits Questionnaire (CSHQ-PT) were applied.

Findings:

A statistically significant relationship was found between sleep quality and use of electronic devices before bed, with the exception of television. As a relationship between sleep quality and bullying behaviors, and also between using electronic gadgets before bedtime and bullying behaviors just for listening to music. Considering the sleep latency, a negative correlation was found with daily videogames use.

Conclusions:

There seems to be a relationship between sleep quality and bullying behaviors in school, and between the use of electronic devices and sleep quality. Also listening to music at bedtime is positively related to bullying behaviors. On the other hand, the videogames daily use before bedtime affects in a significant manner the children' sleep latency (and the sleep REM)..

1. Introduction

Sleeping can be conceived as a physiological need of a neurobiological nature that begins to organize itself even in the intrauterine environment. All the physiological activity involved is complex and integrates certain brain regions, suffering from alternation between wake and rest cycles. These cycles occur successively throughout the night and promote the organization of a dynamic that balances the hormonal, psychological and neurological dimensions (Valle, Valle & Reimão, 2009). The sleep cycles arise alternately, repetitively and are reversible (Cías, Zuaznábar, & López, 2006).

Sleep is organized in stages of sleep and wake, here is an oscillation between moments of rest, where there are no responses to the stimuli dominating the stillness. The other moment refers to the wakefulness where there is reactivity to the stimuli. They are complex neurobiological processes that promote the regular alternation of sleep cycles. There is a whole set of multifactorial dimensions that structure the dynamics of the circadian sleep processes and homeostatic processes (Bertolazi, 2008; Parchão, 2011).

We find four stages that structure sleep, these refer to the different stages of sleep, 1, 2, 3 and 4. These phases occur during REM (Rapid Eye Movement) and NREM (Non Rapid Eye Movement) sleep (Ribeiro & Ito, 2010). Sleeping night is only refreshing when several passages occur in each of these phases. Therefore, each phase presents cycles that can be completed between 70 and 120 minutes (Fernandes, 2006).

Good sleep hygiene in childhood is key to promoting adequate, restful sleep. It is an essential factor for children to have a balanced development (Bruni & Novelli, 2010). The role of sleep in the development of the human being is undisputed, having adequate sleep hygiene assumes as a relevant promoter for a healthy physical, mental and social well-being of children and adults. Sleep is a multidimensional construct and a component that interferes with the individual's total activity during the 24 hours (Matricciani, Yu Sun, Lallukka, Kronholm, Wake, Paquet, Dumuid, & Olds, 2018).

Sleep quality interferes with learning skills, memory capacity, concentration, attention and interferes with emotional and behavioral regulation (Bruni & Novelli, 2015). Therefore, sleep quality can influence the way children organize their emotions and their behaviors to the next day.

Sleep hygiene integrates the whole set of habits acquired before bedtime and allows the organization of sleep at the level of quality and quantity (Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010; Zimmerman, 2008). However the needs of the human being on the level of quality and quantity depend on his age. It is noteworthy that several investigations assume that in general individuals tend to sleep less than a few decades ago. Also, children are sleeping less than they slept a few years ago (Matricciani et al., 2011). Authors acknowledge that possibly 30% of school-aged children present poor sleep and that 40% of children may experience sleep problems at any time of their life (Owens, 2007).

Sleep problems can be transient and disappear without requiring specific intervention, as they can remain for some time and compromise dimensions important for children's development, such as emotional, behavioral, learning, memory, physical health regulation and mental health of the child. Some of these problems may be the so common difficulty in falling asleep, sleep apnea, waking up often, agitation, feeling too tired and drowsiness in the vigil period (Paavonen, 2014; Santos et al., 2015).

1.1. Sleep and Bullying Behaviors

Bullying can be defined as an aggressive behavior repeated with the intention of harming or disturbing someone. The bullying behavior can be physical (hitting, pushing or kicking), verbal (calling names, provoking, threatening and spreading rumors), or exclude socially. The most common type of violence in school settings is school bullying. This type of behavior can have serious consequences for the mental health of both the victim and the aggressor. Given the prevalence of bullying in our school

universe, it is important to reflect on the variables that may influence or facilitate the occurrence of aggressive behaviors in children of school age.

Sleep interferes with children's behavioral and emotional regulation (Gregory & Sadeh, 2012; Kamphuis et al., 2012; O'Brien et al., 2011; Vriend et al., 2013). Poor sleep hygiene, with uncertain sleep schedules, sleep deprivation and sleep disturbances are associated with a greater tendency to present behavioral problems, lack of attention, increased propensity for aggression and hyperactivity (Afano et al., 2009; Dahl, 2006, Haynes et al., 2006, Kamphuis et al., 2012, Muñoz-Quintero & Bianchi, 2017, Peach & Gaultney, 2013).

Sleep problems are associated with behavioral changes in children, also related to lower academic performance (Muñoz-Quintero & Bianchi, 2017). There is a decrease in performance in different tasks that appeal to neuropsychological dimensions, such as attention and executive function (Sadeh, Grubert & Raviv, 2003; Molfese et al., 2013).

The behavioral problems that may arise due to poor quality of infant sleep, both in children and adolescents, are associated with a higher prevalence of aggressive behaviors directed at other subjects (Muñoz-Quintero & Bianchi, 2017; O'Brien, 2009). It is very pertinent to know the sleep habits in children and the quality of the same, and the impact that this can have on variables such as behavior. In this sense, several studies investigated the relationship between sleep and neurobehavioral functioning (Blunden & Chervin, 2008; Ravid, Afek, Suraiya, Shahar and Pillar, 2009).

It is undeniable that sleep problems have an impact on the functioning of the children during the waking hours, presenting more irritability, restlessness, depression symptoms, aggressive behavior and inattention (Muñoz-Quintero & Bianchi, 2017).

An obvious restriction in sleep hours is related to a greater tendency for impulsive and aggressive behavior in school-age children (Biggs, Vlahandonis, Anderson, Bourke, Nixon, Davey, & Horne, 2014). Thus, children with Sleep Respiratory Disorders show a greater tendency for behavioral problems compared to children who do not have such a disorder (Biggs, Vlahandonis, Anderson, Bourke, Nixon, Davey, & Horne, 2014).

Some studies have reported links between poor sleep quality and behaviors that manifest aggressiveness toward peers, some of them antisocial, hyperactivity and attention deficit (Beebe, 2011; Biggs et al., 2011). Children who present difficulties in the quality of sleep are more likely to present emotional changes and difficulties in managing emotions and consequently behaviors. Anxiety arises easily in children with sleep deprivation, who have more difficulty in functioning and emotional regulation (Vriend, Davidson, Corkum, Rusak, McLaughlin, & Chambers, 2012). On the other hand, these authors report that emotional difficulties decrease when poor quality of infant sleep is repaired (Vriend et al., 2012).

Much remains to be clarified at the level of the relationship between sleep quality and emotional and behavioral problems. We know that there may be a bidirectional relationship between these variables, as advocated by Wang, Vaillancourt, Brittain, McDougall, Krygsman, Smith, & Hymel, (2014). These authors report that children with symptoms of depression, anxiety, lack of attention, impulsivity and aggressive behavior show more difficulties in the sleep quality. However, it should be noted that children with sleep problems show greater evidence of attention problems, impulsivity and aggressive behaviors (Wang, et al., 2014). Therefore, Anderson & Platten (2011) report that a bad night is enough to promote a greater reactivity and impulsiveness to adverse stimuli. Thus, sleep deprived subjects show more difficulty in inhibiting an impulsive / aggressive response.

Mattos, Silveira, Ferreira, & Pires, (2014) found interesting associations between insomnia and externalizing problems. Children with sleep deprivation have more aggressive behavior, tendency to break rules or delinquent behavior. They also reveal some internalizing behaviors, characterized by

anxiety, withdrawal, symptoms of depression and somatic complaints. Other behaviors have also occurred as a consequence of lack of sleep, such as attention problems, thinking problems and social problems.

According to the literature, there seems to be a relationship between poor sleep quality and self-regulation difficulties leading to emotional instability and easy reactivity to negative stimuli. In this way, these children present more difficulties in social interactions between peers, making it easier for bullying behaviors to occur in a school context. Children with sleep problems reveal difficulty in controlling impulsivity and aggressiveness in a school context. As such, bullies can not regulate emotions, exhibit easy irritability and difficulty in interpersonal contact (O'Brien, Lucas, Felt, Hoban, Ruzicka, Jordan, & Chervin, 2011). Respiratory sleep disorder is often associated with behavioral problems, because if the child does not get enough sleep due to this disorder, he or she may manifest behavioral and indiscipline problems in school, compared to other children (O'Brien, et al., 2011).

The quality of sleep influences the occurrence of aggressive behaviors, but the existence of bullying behaviors also interferes in the dynamics of sleep (Gomes, Ferreira, Silva, & Castro Caldas, 2017). As such, children involved in bullying experience poor sleep quality, reduced sleep duration, increased sleep latency, and a greater tendency for sleep disorders. Bullying victims tend to have a poorer sleep quality associated with depressive symptoms. On the other hand, bullies and victim-aggressors also show a greater tendency for poor sleep quality (Gomes, et al., 2017). Sleep quality may have a moderating effect on aggressiveness in aggressors. This suggests a greater vulnerability of the aggressors to the sleep deprivation, revealing a greater tendency towards the manifestation of an aggressive reactivity (Kubiszewski, Fontaine, Potard, & Gimenes, 2014). Aggressive children have less sleep time per night and bedtime during the week and at the weekend quite irregular (Kubiszewski et al., 2014).

Improper sleep disrupts neurocognitive functioning, is associated with an increase in negative emotions and influences the experience of emotions. Poor sleep quality is at the basis of an inability to experience and control emotions according to the context experienced (Palmer, & Alfano 2015).

Sleep allows the adequate regulation of emotions, through the selection of situations, situation modification, attention mobilization, cognitive alteration and response modulation. Therefore, it can influence the ability to identify an emotion as problematic, select an appropriately regulated emotional strategy, and implement that strategy. This allows us to understand how sleep disorders and poor quality of sleep can contribute to the development of self-regulation difficulties and consequently behavioral problems, characterized by impulsiveness and aggressiveness (Palmer & Alfano, 2017).

Van der Helm, Gujar, Matthew, & Walker, (2010) consider that sleep deprivation impairs recognition of human facial emotions. Such findings suggest that sleep deficit interferes with affective neural systems, making it difficult to identify emotions. This difficulty in recognizing emotions may be associated with reduced empathy in the interpersonal context, making it difficult for bullies to recognize suffering in the victim.

1.2. Influence of Electronic Devices on Sleep and Bullying Behaviors

We are currently living in a highly sophisticated world from the point of view of the massive use of technology. Children are born soon to relate to the electronic devices that the parents use more daily and are increasingly fascinated by them. Parents show their children how these gadgets are interesting and crucial to their daily lives, and once they are able to manipulate an object, they are the most desired objects. Soon, television, computers, smartphones, tablets are very present in children lives today. Its prevalence and use is constantly increasing, with important consequences for child development (Goh, Bay, & Chen., 2015).

The school-age population is exposed daily to a variety of stimuli that delay adequate sleep time, which is often replaced by pre-bedtime activities such as watching television, being on the internet,

playing video games. On the other hand, parents due to the daily overhead of working hours let their children stay up late. The simple fact that there are in children's bedrooms electronic devices, such as video game consoles or television, can encourage an increase in activity before bedtime, which negatively influences sleep-wake patterns (Oka, Susuki and Inoue, 2008). The existence of televisions or electronic devices in the children and young people bedrooms negatively influences sleep hygiene. For its existence in a rest setting makes it easier to use and as such can easily delay bedtime (Falbe, Davison, Franckle, & Ganter, 2018). Excessive use of electronic devices is associated with an increase in the body weight of children and young people, associated with a very high sedentary lifestyle (Zaman, & Mifsud, 2017).

Smaller devices, such as smartphones and tablets with Internet access, are particularly worrisome, since by their size, anywhere (even in bed) they facilitate access to all kinds of content, whether emails, texts, games, movies or music, at any time of day or night. These tiny devices are used very close to the eyes which by the intensity of the light of the screens slows the release of the sleep hormone, melatonin. Therefore, the sounds that can emerge from these devices intermittently when receiving messages also help to delay bedtime or wake up. Children who regularly use smaller devices have a higher sleep deficit than those who use TV more often (Falbe, Davison, Franckle, & Ganter, 2018).

As the age advances between children and young people, the use of these devices increases. They often use them as a sleeping ritual and easily wake up to the sound of receiving messages (Lauricella, Wartella, & Rideout, 2015). However, the same authors assume that most children spend more time than recommended by the American Academy of Pediatrics, with electronic devices and screens. The use of television, computers, smartphones and tablets by children is strongly associated with the time of use of the same devices by the parents. This results in an important influence of parents' use of the devices on their children (Lauricella et al., 2015).

The easy access to the use of the devices in the home produces changes in the interactions, in the past a television by family was used, fixed in a place of the house and with a limited use of time and content. Today's families have access to several devices, per each member of the family, which allows for an individualized mobile use. This leads us to a set of vast possibilities related to the use of these devices, such as the amount of time spent, the quality of their content, and the way in which each family promotes rules of use in their family context (Zaman, & Mifsud, 2017). The truth is that we still know very little about the consequences of the massive use of modern technology in terms of cognitive and psychosocial functioning in adults. As well as, the impact that the entire digital environment that surrounds us may have on child development (Kostyrka-Allchorne, Nicholas & Cooper, 2017).

Arora, Brogliac, Thomas, & Taheri, (2014) consider that frequent use of all types of technology is associated with poor sleep quality on weekdays. Whoever hears music often before going to bed or plays video games significantly prolongs the onset of sleep. On the other hand, the authors verified in their study a relation between difficulty in falling asleep and the frequent use of smartphones, videogames and social networks, however it seems that for music listeners the effect is greater. These authors admit that the frequent use of technology before bedtime and during working days is associated with disturbing effects on different sleep parameters.

Some studies point out that it is at an earlier age, that children are physically related to small touchscreen devices, which allow access to different contents with a simple touch of a finger. They often come in with more than one device and start multitasking. Although we do not know the adverse effects of using multiple devices (TV, smartphone, tablet) on children, we know that the time spent using them is excessive.

The American Psychological Association (2015) assumes that children should not exceed 2 hours a day of contact with electronic devices, however it warns that they spend about 5 hours a day using them. Traditional television continues to be children's favorite gadget (Kostyrka-Allchorne, et al., 2017). However, increasingly small touchscreen devices are sought after by children assuming great popularity.

This equipment of its size are of easy transport and use in diverse contexts of the day to day. The simultaneous use of different equipment and its increasingly early use by children creates new challenges for understanding the consequences of this phenomenon and for creating methods of supervision by parents.

Some authors have tried to relate the use of electronic devices with emotional and behavioral dimensions. Mundy, Canterford, Olds, Allen, & Patton, (2016) have confirmed that excessive use of electronic devices can lead to emotional and behavioral changes and may facilitate some aggressive behavior. On the other hand, boys play more video games and have more possibilities for conduct problems. Television viewing is also associated in boys with the highest indicators of hyperactivity / inattention. Girls did not show a relationship between these variables (Mundy, Canterford, Olds, Allen, & Patton, 2016).

It is common for cyberbullying to present a relationship with school bullying, the latter being the first step towards cyberbullying. We know that cyberbullying practitioners are often victim-aggressors and users of electronic devices who see this as a way to maintain aggression even after they return home (Cross, Lester, & Barnes, 2015). On the other hand,

The time that children spend using electronic devices varies greatly. The way they use them, whether in an individual or social context is also a factor to be taken into account. However, the frequent use of these devices in an individual setting may accentuate psychosocial difficulties in children (Hinkley, Timperio, Salmon, & Hesketh, 2017). Such as accentuating difficulties in social-emotional development, at the level of peer interaction or in interpersonal skills.

The easy access of children and young people to new technology, while bringing benefits, is also associated with potential risks. Because they easily become victims of assaults carried out by colleagues through the electronic devices themselves. Therefore, electronic aggression is a problem to be taken into account and involves public health (Ferguson, C. & Olson, C. 2014)

The children exposure to violent video games raises the question whether this negatively influences the quality of interpersonal relationships with aggressive behaviors. Ferguson et al. (2014) explored this issue and found no evidence of bullying behavior in children and young people playing violent video games. Other authors like Milani, Camisasca. & Caravita, (2015) developed a study with children and youth, and found that those who preferred violent games had higher indicators of outsourcing and aggression. These data confirm the relationship between violent video games and problems of aggressive behavior in childhood and early adolescence.

It seems not to be consensual among the different authors the influence that the use of electronic devices may have on child behavior. However, it is noteworthy that some literature points to difficulties of an interpersonal nature, of self-regulation of emotions in children and young people who assume a great use of electronic devices.

1.3. Sleep Quality and the Videogames Use by School-Aged Children

Concerning the videogames use and its frequency during childhood (Parent et al., 2016), recent research had examined the influence of general technology use for the sleep quality and for the sleep habits of children and adolescents (Beyens & Nathanson, 2018; Cain & Gradisar, 2010; Calamaro, Mason, & Ratcliff, 2009; Genuneit et al., 2018; Kevitiyagala et al., 2011; Moorman & Harrison, 2018). Hysing et al. (2015) developed a correlational study with 9.846 students to assess their sleep quality considering a daily basis use of electronic devices before bedtime.

The type of devices and the frequency of their use before sleep time were the main variables achieved with significant impact for the sleep quality. This impact was already verified in more recent studies (Beyens & Nathanson, 2018; Cespedes et al., 2014; LeBourgeois et al., 2017; Moorman & Harrison, 2018), especially for the sleep duration time (Hysing et al., 2015). Other studies were developed to assess the sleep quality of school children regarding their habits with electronic devices before bedtime and by using the actigraphs for temperature measurement during sleep period (Paquin et al., 2014).

On the other hand, attending to the gap in the national literature for the examination of the videogames (and other devices) effect in the sleep quality of school-aged children, with expected influence for the academic achievement, the main goal of the present study was to test the correlation between high frequency use of videogames devices near the bedtime schedules of young children and their sleep quality. The research' milestone implied also the educational interest for the intervention in the home schedules for tasks, videogames and sleep of school-aged children.

2. Problem Statement

This research investigates the relationship between the infant sleep quality, the use of electronic devices and of videogames before bedtime and bullying behaviours in school context.

- Children who have inadequate sleep have self-regulating difficulty, and then react more aggressively to their peers at school. The question arises: does the use of electronic devices before bedtime interfere in the children sleep quality causing them to manifest bullying behaviors in a school context?

3. Research Questions

This study aims to verify the relationship between the use of electronic devices before bedtime, sleep quality and the behaviours of bullying presented in school-aged children in schools.

- Is the quality of children sleep and the use of electronic devices at bedtime related to bullying?
- Whether the use of electronic devices before bedtime affects sleep quality, duration and latency?

4. Purpose of the Study

This study has the following objectives:

- Check the sleep quality of the children in the sample;
- Check if there is a relationship between the use of electronic devices before bed and the children sleep quality;
- Find out if there is a significant relationship between sleep quality and bullying behaviors at school;
- To verify the relationship between the use of electronic devices, sleep quality and bullying behaviors in school-aged children;
- To examine the relationship between the daily use of electronic devices before bedtime and the sleep infant quality, specifically how affects the sleep duration and the children' sleep latency.

5. Research Methods

To attend both goals, two different studies were established in Portuguese schools with two samples of school-aged children. Quantitative methods were adopted to examine the collected data. We will address both studies and respective results as Study 1 and Study 2 along with the sections below.

5.1. Study 1

Participants

In the first group the children who participated in this study, present ages between 6 and 12 years of age ($M = 8.5$, $SD = 1.2$), all of them attend primary school and total 860. These are divided into 425 of the male gender (49.4%) and 435 of the female gender (50.6%). All of them had to defined inclusion criteria and all parents had to authorize their participation.

The second group consists of 51 children aged 7 to 11 years.

Table 01. Characterization of the sample: gender and year of schooling

	N	%
<i>Nero</i>		
Feminino	435	50,6
Masculino	425	49,4
<i>Idade (M;DP)</i>	8.5 (1.2)	
<i>Ano frequentado</i>		
1º ano	189	22,0
2º ano	200	23,3
3º ano	222	25,8
4º ano	249	29,0

5.2. Instrument and Procedures

The instruments used are suitable for measuring the variables under study. The children completed a set of three questionnaires: a sociodemographic questionnaire, the Pittsburgh Sleep Quality Index, and the Bullying Questionnaire - aggressiveness among children in the school setting. Finally, parents completed the Children's Sleep Habits Questionnaire.

5.2.1 Sociodemographic questionnaire

This questionnaire was prepared for the present investigation and can be divided into two parts. The first part contains questions about the sociodemographic characteristics of the child and parents. The second part contains questions about the child's sleeping habits and the use of electronic devices before bed and their presence in the bedroom.

5.2.2. Children's Sleep Habits Questionnaire (CSHQ-PT) (Owens, 2000, Portuguese version adapted by Silva, Silva, Braga, & Neto, 2014)

This questionnaire consists of 45 items addressed to parents. It analyzes sleep quality of children 2 and 10 years of age. It includes questions about sleep habits and common symptoms of sleep disorders in school-age children such as: bed rest, sleep onset, sleep duration, sleep anxiety, nocturnal awakenings, sleep-disordered breathing, and daytime drowsiness.

Parents respond according to sleep behaviors that have recently occurred in an ordinary, everyday, family day. The items are evaluated on a 3-point Likert scale, with 1 = "usual" (5 to 7 times a week), 2 = "sometimes" (2 to 4 times a week) and 3 = "rarely" time or never). It presents good internal consistency with a Cronbach alpha of .78 for the full scale of 33 items and ranges from .44 to .74 on the subscales. The test-retest reliability for the subscales (Pearson correlations, $n = 58$) ranged from .59 and .85. Children's Sleep Habits Questionnaire (CSHQ) (Silva, Silva, Braga, & Neto, 2014.) It is a retrospective questionnaire, composed of 45 items addressed to parents, which aim to analyze the sleep behavior of

children between two and 10 years of age. It includes questions about common symptoms of sleep disorders in school-age children such as bed rest, sleep onset, sleep duration, sleep anxiety, nocturnal awakenings, sleep-disordered breathing, parasomnias, and daytime sleepiness. Parents are asked to remember sleep behaviors that occur during a recent "typical" week. The items are evaluated on a 3 point Likert scale, with 1 = "usual" (5 to 7 times a week), 2 = "sometimes" (2 to 4 times a week) and 3 = "rarely" time or never). It presents good internal consistency with a Cronbach alpha of .78 for the full scale of 33 items and ranges from .44 to .74 on the subscales. The test-retest reliability for the subscales (Pearson correlations, n = 58) ranged from .59 and .85. This questionnaire showed psychometric properties similar to the versions of other countries and suitable for the evaluation of sleep disorders in children (Silva, Silva, Braga, & Neto, 2014).

5.2.3. Índice de Qualidade de Sono de Pittsburgh (PSQI) (Buysse et al., 1989; portuguese version adapted by Ramalho (2007, cit. In Seixas, 2009).

Pittsburgh Sleep Quality Index (PSQI) constructed by Buysse, Reynolds, Monk, Berman, & Kupfer, (1989). It was used the Portuguese version adapted by Ramalho, 2007 (2007, cit. In Seixas, 2009). The IQSP is considered a very effective instrument and can be applied in children from the age of 6 years. It is aimed at measuring the quality and patterns of sleep in the month prior to its application. Seven parameters can be analyzed: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and dysfunction related to daytime sleepiness. It consists of a total of 19 items of self-response, of which 15 items are multiple choice and related to the frequency of sleep disturbances and subjective sleep quality and the remaining 4 items are written response and refer to bedtime and to wake up and to the latency and sleep duration . All items are rated on a scale of 0 to 3, with 0 = "no time", 1 = "less than once a week", 2 = "once or twice a week" and 3 = "three times a week or more ", making a total of 21 points. A score equal to or greater than 5 indicates poor sleep. Buysse et al. (1989) obtained a .83 Cronbach's alpha, revealing a very good internal consistency with great reliability. When the instrument was adapted to the Portuguese population obtained a Cronbach alpha of .66, revealing an internal consistency somewhat lower than that of the original scale.

5.2.3. Bullying Questionnaire - aggressiveness among children in the school space (Olweus, 1989, Portuguese version adapted by Pereira & Tomás, 1994 and reviewed by Pereira & Melim, 2010)

This Bullying questionnaire is divided into 4 areas, the first integrates the sociometric data. The second refers to victimization behaviors, frequency, how they happened and where they occurred, characterizes aggression with regard to the number, gender and age of the aggressors, the gang of aggressors, if teachers and school staff often intervene in these situations, if the victims complained, if a colleague tried to defend them during the aggression and finally what his attitude when observing a colleague to be a victim of bullying. The third part of the questionnaire explores behavior of aggression carried out by the respondent, the frequency with which they occur, motivation for aggression, and the existence of behaviors in a group of bullying. The questionnaire ends by asking the student if he or she would help assaulting a classmate for not liking him (Melim, 2011). As for the reliability of the instrument, a high average correlation coefficient was obtained in the various issues of the instrument. Cronbach's alpha coefficient that measures the overall internal consistency of the items in the questionnaire was 0.78 (Moreira, 2007).

To operationalize the dimensions associated with bullying and to understand the data statistically, it is important to clarify and differentiate the concepts of:

- Students who are victims of bullying - are those who have assumed that they have been bullied during the defined period;

- Students not involved in bullying - are those who assumed they were never beaten or assaulted during the defined period;
- Students bullying aggressors - are those who admitted to having promoted aggressions during the defined period;
- Student victims-aggressors - are those who admitted having been victims of bullying and have promoted aggressions during the defined period.

5.3. Procedures

All school principals were contacted and meetings were held with them to explain the research objectives and procedures of the school. All the children took letters addressed to their parents, with a brief explanation about the purpose of the study and request of consent for the children's participation in the study. Only data were collected with children who were authorized by their parents. The questionnaire (CSHQ-PT) was completed by parents at home within one week. These questionnaires were later delivered to the school secretaries and collected by the researchers. All the children answered the questionnaires in the schools, the youngest ones were helped individually in filling out the questionnaires, while the older ones filled them in small groups or together with the whole class. All questionnaires were answered only once.

5.4. Study 2: Preliminary Results

N= 51 subjects aged between 7 and 10 years old (M = 8.6; SD = 1.0), 28 females (n = 54.9%), 23 males (n = 45.1%), from the 1st Cycle of the Basic Education System (Portuguese public schools from the Cascais area, Lisbon district). 75% had brothers and 47% were from families living together in the same home setting (father, mother and brothers). Mothers presented a mean age of 38.8 years old (SD = 4.2) and 40.8 yr old (SD = 4.9) for fathers.

Instruments: Sociodemographic Questionnaire (1) and Portuguese version of the Children's Sleep Habits Questionnaire (2) (CSHQ, Owens, Spirito, & McGuinn, 2000) of Silva, Silva, Braga et al. (2014). The CSHQ is a parent self-report questionnaire (Likert scale) regarding the sleep routines and disturbances of children (4-10 yr old) in the week before or a recent week as convenient to characterize the sleep quality of the infant. From the original 45 items, the Portuguese authors considered 33 organized in 8 different subscales: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, nocturnal awakeness, parasomnia, sleep respiratory disorders and diurnal somnolence (Silva et al., 2014).

The original CSHQ presented appropriate reliability to assess sleep habits of school-aged children (Cronbach alpha .68 for non-clinical sample (N = 469) and Cronbach alpha .78 for clinical sample (N = 154); test-retest with values between .62 and .79, Owens et al., 2000), The same reliability results were achieved (.78) for the Portuguese version of Silva et al. (2014). In the present study, the internal consistency was .71, considered as appropriate for our research development.

The statistical analysis was performed by using absolute and relative frequency descriptive tests (%) as well as the inferential statistics. The SPSS version 25 was used.

6. Findings

From the analysis of sleep habits of this sample, the children go to bed at 9:28 p.m., (average value) ranging from 8:00 p.m. to 11:30 p.m. Most of them fall asleep (52.4%) enjoy sleeping (83%) and almost all are controlled by their parents when it comes to bedtime (96.3%). Before sleeping, most people watch television (81.7%), play games (65.2%) and do not talk to the cell phone (87.3%) or listen to music

(82.7%). Most of the devices used are Tablets (40.2%) and Playstation (20.3%). Most people who play games, before sleeping, do it in the living room (70.8%) or in the bedroom (42.6%).

6.1. Part I – Results

Bullying occurrence

Children who claim to have been victims of bullying already account for almost 70% of the total. Of the total, 61.2% said they had also practiced at least one aggression. Those that were only victimized (n = 233) assumed 27.1% of the total while the only aggressors (n = 62) represented 7.2% of the total.

Sleep quality

In the CSHQ-PT and according to the cutoff values we can identify 50.3% of children (n = 433) with sleep disturbance.

The results point to the existence of a statistically significant relationship between sleep quality and bullying behaviours, $\chi^2(3) = 27.795$, $p = .001$. Children who are neither victims nor aggressors have a better quality of sleep (28.7% vs 13.5%) than children categorized simultaneously as victims and abusers with poor sleep quality (50.5% vs 38.1%).

From the results obtained in the Pittsburgh Sleep Quality Index (PSQI) we found the following statistically significant differences:

Bullying and sleep quality (PSQI dimensions)

	Not a victim nor aggressor		Just aggressor		Only victim		Victim-aggressor		F
	average	SD	average	SD	average	SD	aver.	SD	
Subjective Sleep Quality	,44	,61	,68	,81	,64	,90	,71	,80	7.267***
Sleep latency	,74	,95	,92	1,08	,91	1,05	,96	1,02	2.134
Sleep duration	,02	,16	,02	,13	,03	,24	,03	,21	0.188
Transformed sleep efficiency	,05	,30	,03	,18	,06	,30	,07	,34	0.311
Sleep Disorders	1,10	,57	1,34	,57	1,29	,59	1,40	,60	11,590***
Pills sleeping use	,44	,61	,68	,81	,64	,90	,71	,80	7,267***
Daytime dysfunction	,31	,74	,56	,97	,59	,93	,66	,93	8,470***
Global PSQI	3,08	2,33	4,21	3,06	4,11	2,88	4,51	2,82	14,480***

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Subjective sleep quality, $F(3, 246,211) = 7,267$, $p = .001$, children categorized simultaneously as victims and aggressors have significantly higher values in this dimension than those who are neither victims nor aggressors.

Sleep disturbances, $F(3, 248,318) = 11,590$, $p = .001$, children considered neither victim nor aggressor reveal significantly lower values in this dimension than the other

Use of sleeping medication, $F(3, 246,211) = 7,267$, $p = .001$, children considered as victims and aggressors obtain significantly higher values in this dimension than those who are neither victims nor aggressors.

Daytime dysfunction, $F(3, 245,256) = 8,470$, $p = .001$, children considered simultaneously as victims and aggressors present values significantly higher in this dimension than those categorized as neither victims nor aggressors. Children considered as victims have significantly higher values in this dimension than those categorized as neither victims nor aggressors

Global PSQI, $F(3, 243-816) = 14-480$, $p = .001$, children categorized as neither victim nor aggressor score significantly lower than the rest.

Sleep quality and use of electronic devices before bed

We did not find statistically significant differences in quality and sleep disturbances as a result of watching television before bed.

Children who play games before bedtime have significantly higher values in the Global PSQI, $t(858) = -2.467$, $p = .014$; in the dimension Sleep latency, $t(858) = -2.817$, $p = .005$; Sleep Disorders, $t(858) = -2.815$, $p = .005$; Parasomnia, $t(858) = -3.217$, $p = .001$ and Sleep Respiratory Disturbance, $t(858) = -2.230$, $p = .026$.

Children who talk to the cell phone at bedtime have significantly higher values in the dimension Sleep disturbances, $t(858) = -2.294$, $p = .023$.

Children who listen to music before bedtime have significantly higher values in the Global PSQI, $t(858) = -2.625$, $p = .009$; in the dimension of Sleep Disorders, $t(858) = -3.948$, $p = .001$; in Daytime Dysfunction, $t(858) = -3.037$, $p = .003$; Total CSHQ, $t(858) = -2.134$, $p = .034$; Nighttime awakenings, $t(858) = -2.344$, $p = .020$ and in the Parasomnia dimension, $t(858) = -3.329$, $p = .001$..

The relationship between watching television before bedtime and bullying behaviors is not statistically significant, $\chi^2(3) = 0.624$, $p = .89$ such as the relationship between playing bedtime games and bullying behaviors is also not statistically significant, $\chi^2(3) = 5.599$, $p = .133$. The relationship between talking to the mobile phone before bedtime and bullying behaviors is not statistically significant, $\chi^2(3) = 2.842$, $p = .417$.

The relationship between listening to music before bedtime and bullying behaviors is statistically significant, $\chi^2(3) = 10.416$, $p = .015$. There is a significantly higher proportion of children categorized simultaneously as neither victims nor abusers who do not usually listen to music before bed.

6.2. Part II – Results

72.8% school-aged children watch TV before bedtime and 43.1% play videogames frequently by using several electronic devices (parents identified the devices most used: tablets). Other activities were also verified before bedtime (Table 01).

Table 01. Activities before bedtime: electronic devices use and frequency

Activities	No (N)	%	Yes (N)	%
Television	14	27.5	37	72.5
Videogames	29	56.9	22	43.1
Smartphone	46	90.2	5	9.8
Listen to music	45	88.2	6	11.8

Concerning the impact of the electronic devices before bedtime for the sleep quality (regarding the 8 subscales) the results showed to be significant for the negative correlation between videogames and the sleep onset ($r = -.430$). The correlation has maintained negative and statistically significant for the diurnal

somnolence ($r = .399$). High frequency of electronic devices use before bedtime is moderately related to negative consequences for sleep quality of young children.

7. Conclusion

Study 1

Playing video games before bedtime revealed to have a significant impact on general sleep and specifically on sleep latency, sleep disturbances, parasomnias in respiratory distress. These results are in agreement with the literature Mundy, Canterford, Olds, Allen, & Patton, (2016) related the activation caused by video games with difficulties to start sleep, poor sleep and poor quality of sleep in general and with changes behavioral.

Talking to the phone before bedtime significantly affects sleep in general and specifically in the level of sleep disturbances. This relationship is in line with the Van den Bulck study (2003).

Our results indicate that listening to music affects sleep in general and is particularly related to sleep disturbances, such as: daytime dysfunction, nocturnal awakenings and parasomnias. There are not many studies that relate listening to music to sleep quality, but Arora et al. (2014) found a relationship between listening to music before bed and a reduction of sleep during the weekdays and an onset of sleep about seven minutes longer. However, it is important to point out that the nature of the mechanisms that influence the relationship between listening to music and sleep is not yet fully understood.

No significant relationship was found between exposure to television and sleep quality. We also did not find a relationship between the use of television, games and mobile phones before bedtime and bullying behaviors. However, a significant relationship was found between listening to music before bed and bullying behavior. There is a higher proportion of children not involved in bullying who do not usually listen to music before bed (24.9% vs. 14.1%).

The results of our study confirm the negative influence of electronic devices on sleep quality and there is merely a relationship between listening to music and bullying behaviours. Our analyses indicate that victim-aggressors are the ones who experience the most sleep problems. In addition, we found that the use of electronic devices before bedtime has a negative impact on children's sleep, except for television.

Study 2

The results answered to the research question of this study by examining the correlation between the sleep quality of school-aged children and the electronic devices use before bedtime. The collected data had confirmed the negative influence of the videogames use for the children' sleep quality, specifically concerning the sleep onset time and the diurnal somnolence. Our results are supported by previous evidence that concluded the negative impact of screen devices use by children before bedtime (Beyens & Nathanson, 2018; Brunborg et al., 2011; Cespedes et al., 2014; Gradisar et al., 2013; Higuchi et al., 2005; Hysing et al., 2015; LeBourgeois et al., 2017; Moorman & Harrison, 2018; Nathanson & Beyens, 2016; Oka et al., 2008; Parent et al., 2016; Weaver et al., 2010).

The sleep latency – period measured between the sleep onset and the REM sleep – was seriously affected by the high frequency of videogames near the bedtime of the Portuguese sample. This analysis revealed that high percentage of children has the daily habit of videogames in a period up to 30 minutes (52.2%) or during a 60 minutes' period (13.0%). Also the questionnaires administered allowed to understand that children are authorized by their parents to manage electronic devices use before bedtime and with full monitoring (timetables are established by the parents for the devices use). On the other hand,

the diurnal somnolence was observed in these children during their school schedules as reported in the sleep habits questionnaire.

In fact, the electronic devices use, mostly represented by the videogames, might generate the sleep loss and enable high vigil levels with the “dislocation” of the sleep onset of children (Arora et al., 2014). This behaviour will lead to a diminished sleep latency and consequently to the diurnal somnolence with impact for the academic and cognitive performance during the school tasks. This study should be replicated in similar populations (mainly regarding the school age) to examine how the electronic devices use (and respective schedules at home) may affect the sleep and the general development of humans. Parents should be aware about the revision of schedules for the videogames use and their duration and frequency.

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