

Running head: ELECTRONIC MEDIA USE, SLEEP AND BEHAVIOUR

Just Five More Minutes Please: An Examination of the Relationship between
Electronic Media Use, Sleep and Behaviour in Young Children

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Abstract

This study explored the relationship between electronic media use, sleep and behaviour in preschool aged children. The primary hypothesis of this study was that excessive electronic media use (> 2 hours a day) would positively correlate with sleep patterns (in particular, disturbances) and negative behavioural outcomes (specifically, hostile-aggressive, anxious-fearful and hyperactive-distractible behaviours). Overall, the results indicated a total of 32 significant correlations to support the main hypothesis. However, multiple regression analyses indicated that neither sleep patterns nor electronic media use predicted behaviour. Additionally, MR analyses did not find that electronic media use predicted sleep patterns. Implications for school psychologists and parents are discussed, as well as limitations of the current study and questions in need of further exploration.

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Just Five More Minutes Please: An Examination of the Relationship between Electronic Media Use, Sleep and Behaviour in Young Children

Introduction

Decades of research indicate that sleep is an integral component of physical (Jaffe, Smolensky, & Wun, 1996; Tanaka et al., 2002; Williams & Moroz, 2009) and psychological well-being (Fuligni & Hardway, 2006; Howell, Digdon, Buro, & Sheptycki, 2008; Pilcher & Ott, 1998; Steptoe, O'Donnell, Marmot, & Wardle, 2008). Sleep is associated with mood, cognitive functioning (e.g., learning and memory) (McCoy & Strecker, 2011), academic performance (El-Sheikh, Buckhalt, Cummings, & Keller, 2007), behaviour (Astill et al., 2012) and overall health. Deficiencies in sleep are related to numerous health problems; for example, children who do not receive adequate sleep appear to be at a heightened risk for childhood obesity (Hart & Jelalian, 2008). Sleep loss also leads to disruptions in optimal cognitive performance (Elkin & Murray, 1974), difficulty controlling impulses and emotions, an increased sensitivity to stressors (Minkel et al., 2012) and poor behavioural outcomes (Paavonen, Porkka-Heiskanen & Lahikainen, 2008).

Although the benefits of good sleep, and detriments of poor or insufficient sleep, are well-researched and supported, most researchers to date have focused on adult sleep (Hill, Hogan, & Karmiloff-Smith, 2007). Of the research that is available, some effects of sleep are exhibited differently in children; for example, researchers have shown that sleep impacts memory differently in adults than in children (Van Der Werf et al., 2009; Wilhelm & Born, 2012). In light of the evidence supporting the importance of sleep, it may then be cause for concern that over the last few decades it appears that children's bedtimes are becoming increasingly later, but the time they wake up remains the same (Iglowstein, Jenni, Molinari, & Largo, 2003). In other words, children today are apparently sleeping less than in the past. This bedtime trend may be due to more liberal parental attitudes (Iglowstein et al.) or changes in the

environment (e.g., different school demands). For example, the age of technology has increased the use of electronic media among children and adolescents (Owens et al., 1999). Televisions, computers, gaming systems and so on are a daily part of most Canadian children's lives.

In general, research supports a relationship between the use of technology and disruptions in sleep. Unfortunately, parents seem uninformed about the negative consequences of excessive electronic media use on sleep in their children (Owens et al., 1999). A review of the literature supports a link between media use and disrupted sleep (Cain & Gradisar, 2010); however, the pathway between sleep and daytime functioning remains unclear (Goodlin-Jones, Tang, Liu, & Anders, 2008), especially in young children (Paavonen et al., 2008). The aim of the current study is to explore the relationship between electronic media use, sleep patterns and behaviour in preschool aged children.

What is the Purpose of Sleep?

Researchers have proposed many theories behind the purpose of sleep (Eidelman, 2002), which appears to have multiple important functions. Animal studies have shown that a need for sleep is comparable to that of a need for nourishment (Geier, 1997). We also know that sleep plays a fundamental role in learning and memory (Van Der Werf et al., 2009; Wilhelm & Born, 2012). Human survival is dependent on the ability to absorb and integrate novel information in order to navigate the environment in a safe and efficient manner. Sleep assists in regulating neuronal activity and plays a significant role in brain plasticity, all of which is important for developmental growth and social functioning (Kopash et al., 2010).

The *synaptic homeostasis hypothesis* proposes that sleep is necessary for two reasons. First, the brain may need an opportunity to assess and integrate information absorbed during the day, independent of the environment. Second, certain neurons may be incompatible with others.

Consequently, in order for specific neurons to strengthen, others may need to be inactive (Tononi & Cirelli, 2006). The synaptic homeostasis hypothesis helps to clarify our understanding of how sleep relates to regulatory processes in the body and how sleep may affect behaviour.

The theory posits that the interaction between brain and environment activates neuronal activity, also known as synaptic potentiation, which increases synaptic weight and density. Synaptic strength is augmented while we are awake until it reaches a maximum potential, at which point sleep is necessary to regulate its growth. Sleep, a state when the brain is “offline” (i.e., is not actively managing incoming information), promotes slow wave activity, which is associated with synaptic downscaling (Tononi & Cirelli, 2006). Synaptic downscaling, in turn, improves cellular function (e.g., metabolic functioning), which promotes daytime performance (Sher, 2008). Presumably, when the brain is prevented from engaging in synaptic downscaling, which occurs when sleep is restricted or disturbed, synaptic overload can lead to cognitive, emotional and behavioural impairments (Tononi & Cirelli, 2006).

Chronic sleep problems (e.g., difficulty initiating or maintaining sleep) are widespread among children who exhibit behavioural difficulties. These children tend to have impaired attention, poorer academic performance compared to peers and increased hyperactivity (Blunden & Chervin, 2007). Adequate and consistent sleep predicts a decrease in mental strain and an increase in the ability to self-regulate behaviour over time (Barber & Munz, 2010). However, that which constitutes adequate and consistent sleep varies with age, as normative sleep patterns are developmentally sensitive (Astill, Van der Heijden, Van Ijzendoorn, & Van Someren, 2012).

Normative Sleep Patterns

Sleep is divided into two distinct stages: (1) non-rapid eye movement sleep (NREM) and (2) rapid eye movement sleep (REM); these stages of consciousness are marked by changes in

neurological electrical activity. Throughout the night sleeping individuals alternate between stages of sleep, NREMS switches to REM sleep approximately every 90 to 110 minutes. As the night goes on, the length of REM sleep gradually increases. During NREM, the body is relaxed, but bodily movement continues. When an individual reaches REM sleep, muscles completely relax, eye movements occur and people begin to dream. The amount of time spent in REM becomes similar to that of an adult's time spent in REM at approximately age two (Moorcroft, 2006).

The first stages of childhood mark an important point in the development of established sleep patterns (Iwata, Iwata, Lemura, Iwasaki, & Matsuishi, 2011). Infants spend roughly 70% of the day asleep (Curzi-Dascalova & Challamel, 2000) and awaken approximately 2.5 times a night (So, Adamson, & Horne, 2007). Newborns sleep most during the first month of life, with sleep decreasing over the span of the first year; they sleep more than older children and adults because their brains are still developing (Moorcroft, 2006). Infants also have markedly different sleep patterns than any other age (Moorcroft, 2006) and show greater variability within their sleep patterns than older children (Sadeh, Lavie, Scher, Tirosh, & Epstein, 1991). Sleep patterns include: bedtime, sleep onset time, sleep end time, sleep duration, number of nighttime awakenings, sleep latency, sleep efficiency and number of daytime naps (Galland, Taylor, Elder, & Herbison, 2012). Shorter sleep latencies are associated with earlier bedtimes and earlier sleep onset times, as well as longer sleep durations and shorter nighttime awakenings – which form an ideal sleep pattern (Iwata, Iwata, Lemura, Iwasaki, & Matsuishi, 2012).

Sleep in the Preschool Years

Once children reach the toddler/preschool years they typically fall into a heavy sleep rapidly and are difficult to rouse. They remain in this deep sleep for roughly one hour, at which

time they commence to alternate between a state of sleep and arousal. This stage is characterized by additional movement; they may touch their face, make sounds, blink or wake up. They interchange between NREM and REM sleep approximately every 60 minutes (Moorcroft, 2006). Young toddlers typically have between one to two awakenings each night, which last for approximately 5 minutes, and wake more often than older children. Children who nap during the day are more likely to wake up at night than children who do not take naps. Younger children tend to nap more often and for longer periods of time than older children (Ward et al., 2008); napping generally ceases between the ages of 3-5 years old (Jenni & Carskadon, 2005).

Sleep onset in preschoolers normally occurs around 8:00 in the evening (Crabtree & Williams, 2009). Typical sleep latencies (i.e., the time it takes to fall asleep at bedtime) for children in this age group range between 16 and 17 minutes (Galland et al., 2012). On average, toddlers and preschool aged children will sleep roughly 11.9 hours in a 24-hr period, including naps (Sadeh, Mindell, Luedtke, & Wiegand, 2009). A longitudinal study by Touchette et al. (2007) showed that sleep duration typically remained consistent between 2.5 and 6 years of age and ranged between 10 and 11 hours a night, comparable to sleep duration ranges reported in other studies in this age group (e.g., Ward, Gay, Anders, Alkon, & Lee, 2008). However, typical sleep durations can range between 9.9 and 13.8 hours at this age (Galland et al., 2012). Sleep time diminishes at a rate of 7.8 minutes per year between the ages of 1 to 4 years, declining to approximately 5.9 minutes per year beginning at age 5 (Galland et al., 2012). On average, girls sleep 22.14 minutes longer each night than boys (Moore et al., 2011).

Many factors are related to sleep patterns; for example, high caloric food consumption late in the evening is associated with disturbed sleep (e.g., longer sleep latency) (Crispim et al.,

2011) and the longer it takes a child to fall asleep, the poorer his or her sleep quality becomes (Iwata et al., 2012).

Sleep Disturbances

Sleep difficulties are common among children; for example, approximately 25% of children experience insomnia (Taylor & Roane, 2010), characterized by difficulty initiating or sustaining sleep (American Psychiatric Association, 2000). Children suffering from insomnia will often refuse to go to bed or make attempts at delaying bedtime; they may also repeatedly request a particular item or person to fall asleep with them each night (Taylor & Roane, 2010). Sleep disorders are especially prevalent among children with learning disabilities, developmental delays and certain psychiatric disorders (e.g., anxiety or depression) (Stores, 1992).

Common sleep disturbances among children include: the inability to fall asleep or remain asleep, rousing too early, daytime fatigue, night terrors, extreme agitation, snoring and other atypical nighttime behaviours (Stores 1992). Signs of sleep disorders include: falling asleep at inappropriate times (e.g., in class), a duration of 30 minutes or longer to sleep onset, going to bed late, difficulty rising in the morning, extreme snoring with pauses in breath, feelings of jitteriness in the legs and a reduced ability to concentrate or focus during the day (APA, 2000).

The *Diagnostic Statistical Manual of Mental Disorders* (DSM-IV; APA, 2000) divides primary sleep disorders into two categories: parasomnias (e.g., sleepwalking) and dyssomnias (e.g., insomnia). Parasomnias include behaviours such as frequent nighttime awakenings, sometimes caused by exceptionally disturbing dreams, and leaving bed while still asleep (APA, 2000). These behaviours are frequently distressing to parents and children (Kotagal, 2009). Examples of dyssomnias include sleep disturbances caused by breathing conditions (e.g., sleep apnea), regular excessive sleepiness, or uncontrollable periods of sleep during the day (APA,

2000). As previously mentioned, sleep problems are associated with poor cognitive and behavioural outcomes. For example, hypersomnia is frequently comorbid with cognitive problems (e.g., attention and memory difficulties) and atypical behaviours (e.g., hypersexuality) (Yilmaz, Uyar, Adaletli, & Kilincaslan, 2008). Sleep disordered breathing (SDB) in early childhood is associated with harmful behavioural outcomes later in life, which include hyperactivity, conduct problems, emotional disturbances and difficulties with peers (Matthews, 2012).

Children who sleep longer and who have a shorter sleep latency score higher on measures of optimism and self-esteem, both of which predict enhanced physical and mental well-being, even after adjusting for other factors that may affect sleep patterns (e.g., BMI, age, sex). Additionally, sleep quality and quantity are related to higher teacher ratings of self-esteem and social competence (Lemola et al., 2011). These results highlight the role of sleep in relation to positive characteristics and psychological well-being in children, both of which are related to fewer negative social interactions and behaviours (Steptoe et al., 2008). A commonly overlooked behaviour that researchers have shown is associated with sleep disruptions is the use of electronics and media technologies, such as television (TV) and computer use (Garrison, Liekweg, & Christakis, 2011).

Electronic Media Use and Sleep

Sleep hygiene refers to behaviours conducive to proper sleep. These behaviours include appropriate sleep schedules (e.g., optimal bedtime for age), healthy sleep habits (e.g., avoiding caffeine before bedtime), an environment that supports sleep (e.g., dark and quiet) and physiological practices that aid sleep (e.g., relaxation exercises to help calm the mind) (Hale, Berger, LeBourgeois, & Brooks-Gunn, 2011). A widespread activity that is not in line with sleep

hygiene principles is electronic media use. As previously mentioned, the use of electronics can make it difficult to fall asleep. Researchers have shown that electronic media use can extend sleep onset (Cain & Gradisar, 2010) and difficulties falling asleep and poor sleep quality may then disturb sleep schedules; in turn, irregular sleep schedules negatively impact sleep patterns. For example, greater weekend-weekday divergences in sleep times are associated with longer sleep latency, later sleep onset time and less sleep on weekdays. Inconsistent bedtimes on weekdays may cause a child to try and compensate by sleeping longer on weekends, which then reinforces the adverse sleep patterns on weekdays (Iwata et al., 2012). Thompson and Christakis (2005) found that television viewing in toddlers is related to irregular sleep schedules, independent of other factors that could potentially contribute to changes in sleep schedules. Irregular sleep schedules may then lead to disruptions in sleep quantity and quality that can lead to poor behavioural outcomes.

A review of the literature on television and its impact on youth sleeping patterns indicates that the consumption of electronic media has substantially increased over the past decade (Jolin & Weller, 2011). Permissive parenting has been linked with high levels of television viewing in children. A study of 431 parents with 10 to 11-year-old children indicated that permissive mothers allow their children to watch more than 4 hours of TV each day. Permissive mothers were 5 times more likely than authoritative parents to allow their children to watch this much television in one day (Jago et al., 2011). This is concerning because electronic media use appears to negatively affect sleep-wake patterns of children (Oka, Suzuki, & Inoue, 2008). A study by Asaoka, Fukuda, Tsutsui, and Yamazaki (2007) showed that TV viewing affected sleep-wake patterns in university students. Limiting television to 30 minutes per day

increased sleep duration and led to an earlier bedtime, suggesting that TV was one possible factor contributing to later sleep onset.

Additionally, in the 21st century it is extremely common for children and adolescents in Northern America to possess an electronic device in their bedroom, despite the fact that researchers have shown a relationship between sleep problems (e.g., late sleep onset and daytime tiredness) and at least one electronic device in the bedroom, televisions. Calamaro, Yang, Ratcliffe, and Chasens (2012) studied a sample of 625 children between the ages of 6 and 10 years old and found that, not only did almost half of them have a TV in their bedroom, but that the presence of three electronic media items was associated with approximately 45 minutes less sleep each night than children who did not have electronics in their bedrooms. The presence of these electronic items was related to a greater reduction in sleep than consuming caffeinated beverages, which was associated with only 15 minutes less sleep, compared to children who did not consume caffeinated beverages. Oka, Suzuki, and Inoue (2008) also found that children who had TV's in their bedroom went to bed significantly later on weekends than those who did not have TV's in their bedroom and that technology in the bedroom was associated with increased activity before bed.

In a survey of 470 Israeli adolescents, Shochat, Flint-Bretler, and Tzischinsky (2010) found that 60% of those surveyed had either a television or a computer in their bedroom. Having either electronic media outlet in the bedroom was associated with later sleep onset, later wake-up time and shorter sleep duration than adolescents who did not have either in their bedroom. The adolescents also reported sleeping less than 7.5 hours a day, spending approximately 3 hours per day watching television and 2.5 hours on their computers. In a 2004 national sleep survey of Americans, the results indicated that a TV in the bedroom was associated with poor sleep in

children between kindergarten-age to school-age. On average, the presence of a TV in the bedroom was associated with approximately 30 minutes less sleep a night in comparison to peers who did not have one present. Other studies have also found that children who have televisions in their bedroom have shorter sleep durations than those who do not (Mindell, Meltzer, Carskadon, & Chervin, 2009).

Additionally, exposure to more than two hours of television viewing a day is related to an increase in sleep difficulties (Jolin & Weller, 2011), which may result from excessive light exposure. In turn, these sleep disturbances are associated with attentional difficulties, relational problems and poor academic achievement (Jolin & Weller, 2011), because, as previously discussed, sleep promotes optimal cellular functioning, which affects cognitive functioning and daytime behaviour. Therefore, when children engage in practices that disturb sleep quantity or quality, such as electronic media use, it may lead to negative cognitive and behavioural outcomes. For example, Sisson, Broyles, Newton, Baker, and Chernausek (2011) found that TV's in the bedroom are associated with inadequate sleep and problematic social behaviour.

However, Foti, Eaton, Lowry, and McKnight-Ely (2011) surveyed a group of American adolescents and found that students who watched more than four hours of TV a day received sufficient sleep, whereas adolescents who used a computer for more than two hours a day were more likely to have insufficient sleep. These findings mirror previous research that has found no associations between TV and sleep disruptions (Brunborg et al., 2011; Gupta, Saini, Archarya, & Miglani, 1994). The mixed results may be due to methodological differences in assessing sleep disruptions. The study by Foti et al. investigated the relationship between sleep duration and TV viewing, whereas other studies have looked only at sleep quality. The authors of this study also did not compare sleep patterns of adolescents who kept a TV in their bedroom to those who did

not have a TV in their bedroom. If a TV is playing while one sleeps it may impact sleep in different ways than merely watching TV throughout the day (Foti et al.).

Another explanation is that, unlike computer use, watching television is more of a passive activity and may not engage the brain to the same extent as computer activities. Other factors may need to be taken into account to clarify the mixed findings (e.g., electronic media use amounts and times when electronic media is used). For example, using any kind of electronic media directly prior to sleep may cause sleep disturbances (Mesquita & Reimao, 2010) and children who watch television in the evening or those who are exposed to violent content are more likely to experience sleep difficulties than children who view (nonviolent) television primarily during the day (Garrison et al. 2011).

One theory proposes that bright light, such as the light emitted by electronics, reduces the amount of melatonin an individual secretes, which is necessary for sleep regulation. Therefore, suppression in melatonin results in disturbed sleep due to circadian rhythm changes impacted by the decrease in melatonin (Kubota et al., 2002). Notably, excessive light exposure from media outlets is associated with sleep deprivation and exhaustion (Tazawa & Okada, 2001). Television viewing, video games, internet surfing and other electronics have been linked to self-reports of fatigue in adolescents, which relates to daytime performance (Owens, 2004).

Sleep and Behaviour

Researchers have shown that synaptic activity is highly sensitive to sleep loss (Longordo, Kopp, & Luthi, 2009). Of significant importance is the fact that changes in neurotransmission due to sleep loss have negative implications for cognitive performance (Longordo, Kopp, & Luthi, 2009). Sleep disturbances often result in inattention, poor concentration and memory deficits – all of which are important components of executive functioning. Executive dysfunction

can then lead to behavioural difficulties (e.g., poor impulse control) (O'Brien, 2009). Both short sleep duration and sleeping problems are associated with inattention and behavioural difficulties in young children (Paavonen et al., 2008).

Sleep loss in children may manifest as irritability, frustration, daytime fatigue, difficulty paying attention, crying and aggression. These behaviours can occasionally resemble symptoms characteristic of attention deficit hyperactivity disorder (ADHD) (Dahl, 1996). Touchette et al. (2007) followed a large sample of 1492 children from the age of approximately 5 months to 6 years of age and found that children who regularly slept less and those trending towards shorter sleeps were at a 3.2 times greater risk for developing hyperactive and impulsive behaviours. An epidemiological study of 8-year-old children by Pesonen et al. (2010) revealed a similar negative correlation between sleep duration and problem-solving ability, attention and ADHD-like symptoms.

Bates, Viken, Alexander, Beyers, and Stockton (2002) explored the relationship between sleep and adjustment in preschoolers. The authors noted that children who did not seem to receive adequate sleep often displayed poor emotional and behavioural self-regulation. The authors had mothers complete sleep diaries for their children and then compared the reports with behavioural measures completed by the children's teachers. The results indicated that disrupted sleep was negatively correlated with positive adjustment in preschoolers. This pattern occurred even after controlling for family stress and management; sleep disruptions independently accounted for a significant portion of variation in behaviour. Based on a meta-analysis of 86 studies of young children, Astill et al. (2012) found a positive relationship between sleep duration with both behaviour and cognition. Specifically, sleep duration was related to executive

functioning and school performance. Sleep duration also had a negative relationship with both internalizing and externalizing behavioural problems in children.

A study by Yokomaku et al. (2008) found that preschoolers who had late bedtimes (after 9:00 in the evening) more than twice a week had elevated scores on the Child Behaviour Checklist (CBCL). The CBCL indicated elevated scores on the withdrawn, anxious/depressed and aggressive behaviour subscales. These children also had shorter nocturnal sleep durations, later bedtimes and wake-up times, more irregularities in sleep patterns and took longer naps during the day than the comparison group. Additionally, there were positive correlations between later bedtimes and social problems, as well as between greater range of variation of bedtimes/wake up times and social problems. Externalizing behaviours in preschool children seem to be related to irregular sleep schedules (Yokomaku et al., 2008). Additionally, sleep loss is predictive of more depressive symptoms in otherwise typically developing school-aged children. Overall, the research indicates that children are more likely to experience adjustment problems when they receive insufficient sleep (El-Sheikh & Arsiwalla, 2011).

Importance of Sleep and Electronic Media use for School Psychologists

Students with academic and behavioural problems comprise the vast majority of caseloads for school psychologists (Buckhalt, Wolfson, & El-Sheikh, 2009). Sleep difficulties are often co morbid with other psychiatric and medical health problems prevalent in students (e.g., anxiety, depression, asthma, obesity, ADHD) (Buckhalt et al.; Hart & Jelalian, 2008) who may be referred to school psychologists. In a survey of 297 families with 5-6-year-old children who filled out the Sleep Disturbance Scale for Children (SDSC), Paavonen, Porkka-Heiskanen and Lahikainen (2008) found that parents and teachers reported significantly more psychiatric symptoms in children who slept a shorter duration in comparison to those who slept longer.

Previous studies have also shown positive correlations between sleep problems and elevated scores on behavioural scales (Shang, Gau, & Soong, 2006; Yokomaku et al. 2008). Sleep correlates with various facets of psychological well-being (e.g., individuals who sleep longer report fewer anxious and depressive symptoms) and is significantly related to reports of personal growth, positive relationships with others, purpose in life, optimism and self-acceptance (Hamilton, Nelson, Stevens, & Kitzman, 2006). It logically follows that sleep must be an important feature of student health.

School psychologists are in a unique position to screen for sleep difficulties, provide interventions and promote education and awareness of good sleep practices and consequences of inadequate sleep. Unfortunately, sleep literature indicates that health care practitioners receive little formal training in pediatric sleep (Mindell et al., 2011; Schreck & Richdale, 2011), with some medical schools covering pediatric sleep topics for as little as 17 minutes (Mindell et al). One survey of health care professionals (Owens, 2001) indicated that between 27% and 45% of professionals simply ask parents “does your child have a sleep problem?” to screen for sleep difficulties. Because health care professionals may rely too heavily on parent reports of sleep, sleep problems may fail to come to their attention, as research indicates that parental knowledge of sleep patterns and sleep development is limited (Schreck & Richdale, 2011). Therefore, research that highlights factors that affect sleep are extremely important for educating health care professionals so that they themselves know what to be aware of when working with clients.

Touchette et al. (2007) found that a decrease of just one hour in sleep predicted poorer performance on verbal and abstract reasoning tasks, both of which require the engagement of higher order psychological processes. Findings such as this have implications for the practice of school psychology because school psychologists partially rely on cognitive testing to help assess

for learning disabilities and other educational difficulties. Intelligence tests are designed to estimate a student's overall intellectual functioning, which is comprised of psychological processes that may be affected by sleep problems (e.g., attention, memory). In fact, Touchette et al. used the exact same tasks school psychologists use to assess cognitive ability. However, although test developers often note that students who are ill should not be tested, they make no mention of considering the effects of sleepiness or the time of day when the child is being tested on results (Buckhalt et al., 2009). If school psychologists do not take sleep, and factors affecting sleep, into account prior to assessing students, then they may not obtain valid and reliable results that accurately predict a student's actual abilities.

There are effective evidence-based interventions that school psychologists could implement to address sleep difficulties comparable to interventions already in place for other common difficulties, such as anxiety. For example, cognitive behavioural therapy (CBT) has successfully been used to address sleep problems. When used to treat sleep problems, CBT typically targets sleep hygiene. A behaviour often addressed in CBT is the reduction of television and computer use 4 to 6 hours before bedtime (Buckhalt et al., 2009). This is important considering children often have televisions in their bedrooms and parents even use electronic media as part of bedtime routines. In a study that surveyed parents of children between the ages of 4 to 10, 76.5% of parents surveyed indicated that TV was a regular component of their child's bedtime routine, despite the fact that TV in the bedroom and higher rates of TV watching were significantly related to bedtime refusal behaviours. Additionally, the analyses indicated that television viewing and a TV in the bedroom positively correlated with sleep problems. However, an overwhelming 89.9 % of parents surveyed did not feel that TV had much or any impact on their child's sleep (Owens et al., 1999).

Unfortunately, studies have consistently shown an association between electronic media use, delayed bedtimes and shorter sleep durations (Cain & Gradisar, 2010). For example, Mindell et al. (2009) found that 30% of preschoolers had a television in their bedroom and that the presence of a television in the bedroom was associated with an 18-36 minute reduction in sleep per night as compared to children who did not have a TV in their bedroom. Therefore, parents need to be made aware of the possible impact of electronic media use on their children's sleep. This is but one facet of sleep that a school psychologist could address, especially if more research indicates that TV and other electronic media use impacts child sleep across age groups.

Additionally, because school psychologists often recommend various assistive technologies following psychoeducational assessments, a sound understanding of potential risks associated with their use is critical. For example, it would not be ethical to recommend the use of a laptop to a very young child if the use of that technology at that age is associated with behavioural consequences (e.g., an increase in inattentive behaviour) and if superior alternatives exist.

Current Study

To date, researchers have identified genetic markers for sleep that assist in explaining the brain's vulnerabilities to sleep loss, and have begun to delineate the role of sleep on optimal cognitive functioning (Franken, Kopp, Landolt, & Luthi, 2009). However, despite the wealth of information available concerning the importance of sleep and healthy sleep practices, many parents remain ignorant to the negative consequences of sleep loss on their children's learning and behaviour (O'Brien, 2009). Additionally, because parents apparently do not believe that television affects their child's sleep (Owens et al., 1999), and presumably electronic media use in general, the current study aims to further elucidate the relationship between electronic media use

and sleep. Studies have also shown that television watching habits in young children are affected by parenting style (Carlson, Laczniak, & Walsh, 2001). Therefore, this study attempts to add to the literature on electronic media use, sleep and behaviour in young children to, hopefully, assist school psychologists in increasing parental awareness of normative sleep patterns in young children and to help educate them on the impact of electronic media use on sleep and behaviour.

Unfortunately, researchers have found mixed results for the impact of electronic media use on sleep patterns in young children, which may be partially attributable to methodological problems that do not take both sleep quality and sleep duration into account. Researchers have also shown that sleep duration and sleep quality may have different behavioural outcomes. Therefore, the current study will attempt to shed light on some of these mixed findings by examining both these factors in relation to electronic media use and behaviour.

Additionally, sleep loss appears to be developmentally sensitive and affects various age groups differently (e.g., sleep affects adults and children differently); therefore, sleep should be studied across the lifespan (Astill et al., 2012). Although some research indicates a negative relationship between electronic media use and sleep in older children, little research has studied the effects of electronic media use on sleep in preschoolers; little is known about the impact of electronic media use on sleep patterns in this age group (Thompson & Christakis, 2005). Research on sleep duration and behavioural outcomes in preschoolers is also limited (Paavonen et al., 2008); as a result the current study will attempt to add to this literature.

Moreover, clinical programs do not provide adequate training in the assessment and treatment of sleep problems (Peachey & Zelman, 2012) and school psychologists do not regularly screen for sleep problems, despite their prevalence. School psychologists seem to rely on parents to bring sleep difficulties to their attention, just as most other health care professionals

do. Because parenting styles are associated with sleep disruptions (Owens-Stively et al., 1997) and directly influence child behaviour (Alizadeh, Talib, Abdullah, & Mansor, 2011), it is important to increase parental sleep knowledge and to teach children at a young age good sleep practices, as sleep problems may remain stable across the lifespan if left untreated. The current study also hopes to highlight possible consequences of electronic media use so that school psychologists may keep this information in mind when making recommendations; for example, understanding possible ramifications of recommending assistive technology following psychoeducational assessments.

The current study explores the relationship between electronic media use, sleep and behaviour in preschool aged children. The primary hypothesis of this study is that excessive electronic media use (> 2 hours a day) will positively correlate with sleep patterns (namely, disturbances) and negative behavioural outcomes (specifically, hostile-aggressive, anxious-fearful and hyperactive-distractible behaviours – as measured by the Preschool Behaviour Questionnaire that depicts typical behaviours in this age group). Additionally, the current study aims to explore the relationship between sleep and electronic media use in the prediction of behavioural outcomes in childhood which, to this author's knowledge, has not been previously examined. This study defines sleep patterns as: bedtime (e.g., time the child goes to bed), sleep behaviour (e.g., amount of sleep), nighttime awakenings (e.g., duration of nighttime awakenings) and morning waking (e.g., time the child wakes in the morning).

Method

Participants

Participants were recruited from local preschools and daycares in the Halifax Regional Municipality (HRM). Contacted preschools and daycares were offered a children's book and

entry into a draw for a Staples gift certificate as incentive for participation in the study. A total of 15 child care centre directors were contacted by e-mail and/or telephone to participate in the study; 11 preschools/daycares agreed to participate in all. In total, a parent or guardian and preschool or daycare teacher of 52 children were recruited to complete questionnaires. Twenty seven children were male and 24 were female (one questionnaire was missing information about the child's sex). Children ranged in age between 36 months and 60 months, with a mean age of 45 months ($SD = 7.26$).

Measures

The current study used paper and pencil questionnaires to assess the three variables of interest: (1) sleep patterns, (2) electronic media use and (3) behaviour.

Children's Sleep Habits Questionnaire (CSHQ) (Owens, Spirito, & McGuinn, 2000).

The Children's Sleep Habits Questionnaire (CSHQ) (see Appendix A) was used to measure sleep patterns (one of the two independent variables in this study). The CSHQ is a 45-item parent-report screening tool for sleep disorders that takes approximately 10 minutes to complete. The CSHQ discriminates children with and without sleep problems between the ages of 4 to 10 years old. Parents are asked to think about their child's sleep over the past week and to answer questions about bedtime, sleep behaviour, nighttime awakenings and morning waking on a scale from "usually (occurring five or more times in a week)" to "rarely (occurring never or one time in a week) (Owens et al., 2000) .

The CSHQ has been used in numerous studies to assess sleep behaviour in children (Accardo et al., 2012; Jalilolghadr et al., 2012; Johnson, Turner, Foldes, Malow, & Wiggs, 2012; Price, Wake, Ukoumunne, & Hiscock, 2012) and appears to be a useful screening tool in young preschool-aged children (Goodlin-Jones, Sitnick, Tang, Liu, & Anders, 2008). Psychometric data

were evaluated in a community sample of 469 students from grades kindergarten through grade 4 and a clinical sample of 154 patients diagnosed with sleep disorders. The CSHQ showed adequate internal consistency for the community and clinical samples (0.68 and 0.78, respectively). The CSHQ was also consistently able to distinguish between the community sample and the clinical sample, indicating instrument validity. Test-retest reliability was also acceptable; the Pearson's correlations ranged from 0.62 to 0.79 (Owens et al.). Identifying information items (i.e., child's name and date of birth) were omitted to maintain anonymity.

Electronic Media Use Questionnaire (EMUQ) (adapted from Adachi-Mejia et al., 2007; Brunborg et al., 2011). A questionnaire assessing electronic media use (see Appendix B) was adapted from a television questionnaire developed by Adachi-Mejia et al. (2007) and a computer use questionnaire developed by Brunborg et al. (2011) to measure electronic media use (the other independent variable in this study). The questionnaire included items such as "On average, how many nights per week does your family watch television or movies together?" and "On average, how many hours a day does your child use a computer?" Additional items exploring the use of alternative electronic media (e.g., video game console) were also added.

The Preschool Behavior Questionnaire (PBQ) (Behar, 1977). The Preschool Behavior Questionnaire (PBQ; see Appendix C) was used to measure child behaviour (the dependent variable in this study). Specifically, it measures three independent dimensions of behaviour: Hostile-Aggressive, Anxious-Fearful and Hyperactive-Distractible. The PBQ is a 30-item tool used for screening emotional problems in preschoolers; it was normed on ages 3-6 years old. Data was collected on a sample of 496 children from five preschools across the United States. Originally, the tool included 36 items; however, following analyses on the standardized sample, six items were removed that did not significantly affect the validity of the measure. The removal

of the six items decreased completion time. The PBQ has been shown to be a reliable and valid measure of behaviour in preschool children. The instrument includes a series of items that depict behaviours exhibited by preschoolers (e.g., “Restless; Runs about or jumps up and down; Doesn’t keep still”) that parents rate on a scale of “Doesn’t Apply,” “Applies Sometimes,” or “Certainly Applies.” The questionnaire was developed for easy use by health care professionals and preschool teachers (Behar, & Stringfield, 1974).

Procedure

Preschool and daycare directors were contacted by telephone and/or e-mail and given a description of the study. If they consented to participate, they were asked to distribute envelopes containing questionnaires to parents and guardians of children enrolled at the daycare or preschool where they work to complete on their own time. Each package included a parent/guardian invitation to participate (see Appendix D), a parent/guardian information sheet for informed consent (see Appendix E), two copies of a parent consent form (see Appendix F) and two questionnaires (the CSHQ and the electronic media use questionnaire). There was a tentative, approximately two week, deadline to return the packages to their child’s school written on the envelopes. Following the return of a completed and sealed parent package to a daycare or preschool staff member, the directors were asked to request that a staff member complete the corresponding behavioural measure for the child (i.e., the PBQ). Teachers who agreed to participate received an invitation to participate (see Appendix G), a teacher information sheet for informed consent (see Appendix H) and two copies of a teacher consent form (see Appendix I). As an incentive to participate, teachers were informed that they would be entered into a draw for a Staples gift certificate as gratitude for their assistance with the study. Teachers were asked to staple completed behaviour questionnaires as soon as possible to the front of each returned

package. Additionally, they were asked to not include any identifying information in order to ensure anonymity in participation in the study. The parent questionnaires took approximately 15-20 minutes to complete and the teacher questionnaire took approximately 5-10 minutes to complete. Completed questionnaires were retrieved periodically by the researcher. Following completion of the study, parents and staff who requested results will receive the results of the study via e-mail as indicated on their consent forms. To thank staff and parents for their participation, each participating daycare or preschool will receive one new children's book for their classroom and copies of a letter of appreciation (see Appendix J).

Results

The principal aim of this study was to examine the relationships between sleep and electronic media use in the prediction of behaviour in preschool aged children. The results will be presented as follows: preliminary analyses, correlations, and hierarchal multiple regression analyses. First, preliminary analyses will include tested assumptions, inspection for outliers and exploration of sex differences using t-tests. Second, simple correlations were performed to inspect relationships between variables. Finally, hierarchal multiple regression analyses were used to explore whether behaviour can be predicted from relations and interactions between electronic media use (e.g., number of hours of television watched daily) and sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales).

Please note that based on a factor analysis conducted by Behar and Stringfield (1974) to examine the dimensions measured by the PBQ, only the items showing the highest loading for each of the three behaviour factors (i.e., Hostile-Aggressive, Anxious-Fearful and Hyperactive-Distractible) were used in the following analyses for that measure. Also, because only three parents reported that their child had a TV in the bedroom, the n was too small to explore

relationships between a TV in the bedroom and the other variables. Additionally, EMUQ4 (i.e., when the child usually watches TV) was removed from the analyses as parents interpreted the question in multiple ways (i.e., either replied with “yes” or “no”; circling before school, after school, after supper; or gave an explanation of when their child watched TV), thus making it difficult to code consistently. Finally, all questions requiring a response in hours (with the exception of total amount of sleep each day) were converted to minutes.

Preliminary Analysis

Data screening. All of the data were inspected for outliers, linearity, and homogeneity of variance. No assumptions were violated; therefore, there was no requirement to transform the data. Because there was an N of 52 and a small number of missing data points, missing values¹ were not replaced in order to maintain the true sense of the data.

Sex differences. A series of independent t-tests were conducted in order to explore possible sex differences between sleep patterns, electronic media use and behaviour (see Table 1 for means and standard deviations). Equal variances assumed, significant findings included the following sex differences: males went to bed later than females ($t(48) = 2.61, p = 0.01$) and males scored higher on the Anxious-Fearful factor than females ($t(49) = 2.40, p = 0.02$).

Correlations with age. Pearson correlations were conducted to examine the relationships between age and all variables (see Table 2); there were no significant correlations between age and any of the variables.

Primary Analysis

Principal correlations. Pearson correlations were used to examine inter-correlations within the subscales of sleep (i.e., bedtime, sleep behaviour, nighttime waking and morning waking) and electronic media use and between these predictor variables and the outcome

variable (behaviour). In total, the results revealed 32 significant correlations. Please note that any significant correlations related to EMUQ9 (video game console use) should be interpreted with caution as only two parents indicated that their child used a video game console, thus making the sample too small to interpret and generalize the findings.

Sleep pattern intercorrelations. The correlations within the CSHQ are presented in Table 3. There were significant negative correlations between amount of sleep and the number of minutes that a night waking lasts ($r(35) = -0.50, p < 0.01$); amount of sleep and sleepiness while playing alone ($r(43) = -0.30, p < 0.05$); and amount of sleep and sleepiness while watching TV ($r(38) = -0.42, p < 0.01$). There were also significant positive correlations between sleepiness while watching TV and sleepiness while playing alone ($r(39) = 0.66, p < 0.01$) and between sleepiness while watching TV and sleepiness while riding in a car ($r(37) = 0.47, p < 0.01$). There were significant positive correlations between the number of minutes that a night waking lasts and sleepiness while playing alone ($r(33) = 0.38, p < 0.05$), as well as the number of minutes a night waking lasts and sleepiness while riding in a car ($r(33) = 0.39, p > 0.05$). There was a significant positive correlation between the time children woke in the morning and sleepiness while eating meals ($r(41) = 0.72, p < 0.01$). There was also a significant positive correlation between the morning waking subscale (e.g., mood, appetite, and difficulty getting out of bed) and the time children go to bed ($r(49) = 0.37, p < 0.01$).

Electronic media use and sleep pattern correlations. The correlations between electronic media use and sleep patterns are displayed in Table 4. There was a significant positive correlation between the number of TV's in the home and sleepiness while playing alone ($r(43) = 0.44, p < 0.01$). There were also significant positive correlations between sleepiness while playing alone and computer use ($r(43) = 0.31, p < 0.05$), as well as between sleepiness while playing

alone and other electronic use ($r(41) = 0.43, p < 0.01$). Additionally, there was a significant positive correlation between sleepiness while watching TV and computer use ($r(38) = 0.42, p < 0.01$). There were significant negative correlations between amount of sleep and computer use ($r(47) = -0.38, p < 0.01$); amount of sleep and video game console use ($r(46) = -0.32, p < 0.05$); and amount of sleep and other electronic use ($r(45) = -0.33, p < 0.05$). There was a significant positive correlation between the sleep behaviour subscale and internet use ($r(50) = 0.31, p < 0.05$) and a significant negative correlation between the waking during the night subscale and video game console use ($r(48) = -0.31, p < 0.05$).

Electronic media use intercorrelations. The correlations for electronic media use are presented in Table 5. There were significant positive correlations between the amount of TV watched and the number of TV's in the home ($r(48) = 0.44, p < 0.01$); amount of TV watched and the number of nights TV/movies are watched with the family ($r(48) = 0.54, p < 0.01$); amount of TV watched and video game console use ($r(47) = 0.47, p < 0.01$); and amount of TV watched and other electronic use ($r(46) = 0.34, p < 0.05$). There was a significant positive correlation between the number of TV's in the home and other electronic media use ($r(46) = 0.35, p < 0.05$). There was a significant positive correlation between the number of minutes of internet used daily and the number of minutes of computer used daily ($r(48) = 0.58, p < 0.01$). There were significant positive correlations between the number of minutes of computer used daily and number of minutes of video game console used daily ($r(46) = 0.29, p < 0.05$) and between number of minutes of computer used daily and number of minutes of other electronic media used daily ($r(46) = 0.65, p < 0.01$). Finally, there was a significant positive correlation between number of minutes of video game console used daily and number of minutes of other electronic media used daily ($r(45) = 0.38, p < 0.01$).

Behaviour correlations. The correlations between the predictor variables (sleep patterns and electronic media use) and outcome variable (behaviour) are presented in Table 6. There were significant positive correlations between the amount of TV watched and all three behaviour dimensions (i.e., Hostile-Aggressive ($r(48) = 0.31, p < 0.05$), Anxious-Fearful ($r(49) = 0.28, p < 0.05$) and Hyperactive-Distractible ($r(49) = 0.33, p < 0.05$)). There was a positive correlation between the number of minutes a nighttime waking lasts and the Anxious-Fearful factor ($r(37) = 0.33, p < 0.05$). There was also a positive correlation between the number of TV's in the home and the Hyperactive-Distractible factor ($r(49) = 0.30, p < 0.05$). There were no other significant correlations between the predictor and outcome variables.

Multiple regression analysis. To further our investigation of how the variables were related to one another, multiple regressions were used to determine whether or not grouping the independent variables (sleep patterns and electronic media use) would be predictive of the criterion variable (behaviour). Separate regressions were conducted for each of the three dimensions of the behaviour measure (i.e., Hostile-Aggressive, Anxious-Fearful and Hyperactive distractible) to determine whether sleep patterns and electronic media use were predictive of any of the three factors either independently or when taken together. Results indicated that, regardless of whether the variables were separated or combined, there were no significant findings and, therefore, neither sleep patterns nor electronic media use predicted behaviour. Additionally, multiple regression analyses examined whether electronic media use predicted sleep patterns; there were no statistically significant findings.

However, because we had a sample of 52 participants and the recommended ratio of participants to predictor variable is approximately 15 to 1, for predictive ability and ability to generalize, variables in the predictor list were reduced to three (i.e., the three variables

considered most important in the list). Additional regression analyses were conducted to examine whether using only the most important variables would be predictive of the criterion variable. Again, there were no statistically significant multiple regressions found; however, the results indicated one trend approaching significance. Altogether, six sets of multiple regressions were performed for a total of 19 multiple regressions. The multiple regression analyses are described in the following section.

All sleep patterns as predictor variable. In the multiple regression where the dependent variable was Hostile-Aggressive behaviour and the predictor variable was sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales), the results were not statistically significant ($F(4, 46) = 0.33, p > 0.05$). In the multiple regression where the dependent variable was Anxious-Fearful behaviour and the predictor variable was sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales), the results were not statistically significant ($F(4, 47) = 1.06, p > 0.05$). In the multiple regression where the dependent variable was Hyperactive-Distractible behaviour and the predictor variable was sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales), the results were not statistically significant ($F(4, 47) = 0.36, p > 0.05$).

All electronic media use as predictor variable. In the multiple regression where the dependent variable was Hyperactive-Distractible behaviour and the predictor variable was all electronic media use (i.e., EMUQ 1, 3, 4, 5, 7, 8, 9, and 10), the results were not statistically significant ($F(8, 35) = 1.22, p > 0.05$). In the multiple regression where the dependent variable was Hostile-Aggressive behaviour and the predictor variable was all electronic media use (i.e., EMUQ 1, 3, 4, 5, 7, 8, 9, and 10), the results were not statistically significant ($F(8, 34) = 1.08,$

$p > 0.05$). In the multiple regression where the dependent variable was Anxious-Fearful behaviour and the predictor variable was all electronic media use (i.e., EMUQ 1, 3, 4, 5, 7, 8, 9, and 10), the results were not statistically significant ($F(8, 35) = 0.87, p > 0.05$).

Sleep patterns and electronic media use combined. In the multiple regression where the dependent variable was Hostile-Aggressive behaviour and the predictor variables were all electronic media use (i.e., EMUQ 1, 3, 4, 5, 7, 8, 9, and 10) and sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales) combined, the results were not statistically significant ($F(12, 30) = 0.73, p > 0.05$). In the multiple regression where the dependent variable was Anxious-Fearful behaviour and the predictor variables were all electronic media use (i.e., EMUQ 1, 3, 4, 5, 7, 8, 9, and 10) and sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales) combined, the results were not statistically significant ($F(12, 31) = 1.09, p > 0.05$). In the multiple regression where the dependent variable was Hyperactive-Distractible behaviour and the predictor variables were all electronic media use (i.e., EMUQ 1, 3, 4, 5, 7, 8, 9, and 10) and sleep patterns (i.e., bedtime, sleep behaviour, waking during the night and morning waking subscales) combined, the results were not statistically significant ($F(12, 31) = 1.14, p > 0.05$).

Sleep patterns reduced to three in the predictor list. In the multiple regression where the dependent variable was Hostile-Aggressive behaviour and the predictor variables were the waking during the night mean, bedtime mean and sleep behaviour mean, the results were not statistically significant ($F(3, 47) = 0.34, p > 0.05$). In the multiple regression where the dependent variable was Anxious-Fearful behaviour and the predictor variables were the waking during the night mean, bedtime mean and sleep behaviour mean, the results were not statistically significant ($F(3, 48) = 0.37, p > 0.05$). In the multiple regression where the dependent variable was

Hyperactive-Distractible behaviour and the predictor variables were the waking during the night mean, bedtime mean and sleep behaviour mean, the results were not statistically significant ($F(3, 48) = 0.25, p > 0.05$).

Electronic media use reduced to three in the predictor list. In the multiple regression where the dependent variable was Hostile-Aggressive behaviour and the predictor variables were EMUQ1 (average number of hours of watching TV daily), EMUQ8 (average number of hours using a computer daily) and EMUQ10 (average number of hours using other electronic media daily), the results were not statistically significant ($F(3, 43) = 1.88, p > 0.05$). In the multiple regression where the dependent variable was Anxious-Fearful behaviour and the predictor variables were EMUQ1, EMUQ8 and EMUQ10, the results were not statistically significant ($F(3, 44) = 1.57, p > 0.05$). In the multiple regression where the dependent variable was Hyperactive-Distractible behaviour and the predictor variables were EMUQ1, EMUQ8 and EMUQ10, the results were approaching statistical significance ($F(3, 44) = 2.46, p < 0.10$), with EMUQ1 acting as the strongest predictor of the three variables.

Sleep patterns as outcome variable. In the multiple regression where the dependent variable was the bedtime subscale and the predictor variables were EMUQ1, EMUQ8 and EMUQ10, the results were not statistically significant ($F(3, 44) = 0.90, p > 0.05$). In the multiple regression where the dependent variable was the sleep behaviour subscale and the predictor variables were EMUQ1, EMUQ8 and EMUQ10, the results were not statistically significant ($F(3, 44) = 0.56, p > 0.05$). In the multiple regression where the dependent variable was the waking at night subscale and the predictor variables were EMUQ1, EMUQ8 and EMUQ10, the results were not statistically significant ($F(3, 44) = 1.28, p > 0.05$). In the multiple regression where the dependent variable was the morning waking subscale and the predictor

variables were EMUQ1, EMUQ8 and EMUQ10, the results were not statistically significant ($F(3, 44) = 0.35, p > 0.05$).

Discussion

The main purpose of this study was to examine the relationship between electronic media use, sleep and behaviour in preschool aged children. The primary hypothesis of this study was that excessive electronic media use (> 2 hours a day) would positively correlate with sleep patterns (in particular, sleep disturbances) and negative behavioural outcomes; the primary hypothesis was supported by the results. The results indicated that, overall, there were relationships between electronic media use, sleep patterns and behavioural outcomes. However, using multiple regression, irrespective of whether the sleep and electronic media use measures were combined or separated, sleep patterns nor electronic media use predicted behaviour. Although no statistically significant multiple regressions were found, the results indicated one trend approaching significance. Additionally, t-tests revealed a couple interesting sex differences. The discussion will begin with an overview of the t-test results, pearson correlations and multiple regression analyses, followed by study limitations, implications, future directions and conclusions.

Sex differences

The results showed two sex differences in this study. First, males scored significantly higher than females on the Anxious-Fearful factor. This finding is in line with the results of an analysis of variance computed by Behar and Stringfield (1974) using the short version of the PBQ with a range of preschoolers similar to those participating in the current study, aged three to six, to determine sex effects. However, it appears to contradict many other studies that have

found females to score significantly higher on measures of anxiety and fear (e.g., Bender, Reinholdt-Dunne, Esbjorn, & Pons, 2012; Douglas & Rice, 1979; McLean & Anderson, 2009).

A study by Moller, Majdandzic, de Vente, and Bogels (2013) found that parenting behaviour can affect the development of anxiety differently in girls and boys. Additionally, because researchers have shown that males and females may differ in the types of anxiety they experience (e.g., McCleary & Zucker, 1991), the anxious and fearful symptoms typically exhibited by females may not have been fully captured by the measure used in the current study. For example, Barnett and Scaramella (2013) found that negative parenting was associated with higher levels of externalizing behaviour in preschoolers, and that mothers were more likely to use negative parenting with boys than with girls. Negative parenting styles characterized by reproach, restriction, and inconsistency are associated with low mood, difficulty concentrating, and higher levels of daytime sleepiness in children (Brand, Hatzinger, Beck, & Holsboer-Trachsler, 2009) – all of which could feasibly contribute to anxious and fearful behaviour.

The previous findings indicate the possibility that males in this age group were more likely to experience the anxious and fearful symptoms measured by the PBQ scale (i.e., tends to be fearful or afraid of new things or new situations; appears miserable, unhappy, tearful, or distressed; stares into space; cries easily; gives up easily), which are all externalizing behaviours, than females. This finding may have been partially attributable to parenting differences (i.e., more negative parenting with boys than with girls may have accounted for the sex difference). Examining sex differences in types of anxiety (including what type of anxiety the PBQ measures) and how parenting affects the development of anxiety in this age group may warrant further investigation in future research.

Second, males had a later bedtime than females. Later bedtimes for males may be attributable to a biological mechanism. Females typically have circadian rhythms that are set to an earlier time (i.e., represent an earlier bedtime) and that also result in a propensity to wake earlier (Duffy et al., 2011); this probably contributes to earlier bedtimes than males in the current study. Moreover, women, compared to men, generally do seem to favour earlier bedtimes and later wake-up times (Putilov, Verevkin, Ivanova, Donskaya, & Putilov, 2008).

Correlations

Overall, the results indicated a total of 32 significant correlations to support the main hypothesis that excessive electronic media use (> 2 hours a day) would positively correlate with sleep patterns (in particular, sleep disturbances) and negative behavioural outcomes.

Sleep pattern intercorrelations. There were significant negative correlations between amount of sleep and: the number of minutes that a night waking lasts; sleepiness while playing alone; and sleepiness while watching TV. There were significant positive correlations between the number of minutes that a night waking lasts and sleepiness while playing alone, as well as with sleepiness while riding in a car. These are expected correlations because the less sleep one gets, the more tired one becomes. Researchers have shown that restricted sleep is associated with sleepiness (Haavisto et al., 2010; Maia, Grandner, Findley, 2013). For example, de Souza, de Sousa, Leão Maia, and de Azevedo, (2012) found that earlier wake times and less time sleeping were associated with greater sleepiness in both teachers and students; an association which decreased on weekends when the participants did not have the same restrictions on their sleep. In addition, there was a significant positive correlation between the time children woke in the morning and sleepiness while eating meals. There was also a significant positive correlation between the morning waking subscale (e.g., mood, appetite, and difficulty getting out of bed)

and the time children go to bed. Again, these are logical findings since one would presume the later children go to sleep and the earlier they wake up, the more difficulty they will have during their morning routine and the sleepier they will feel. For example, Boergers, Gable, and Owens (2014) found that delaying school by merely 25 minutes, and thus allowing for longer sleep duration, was associated with reductions in daytime sleepiness in adolescents.

There were also significant positive correlations between sleepiness while watching TV and sleepiness while playing alone, as well as between sleepiness while watching TV and sleepiness while riding in a car. One theory posits that bright light affects the secretion of melatonin necessary for sleep regulation (Kubota et al., 2002). Therefore, the light emitted from a television screen may affect melatonin secretion through changes in room lighting. Sleep is regulated by an internal circadian clock (Moorcroft, 2006), that is sensitive to melatonin; consequently, changes in the environment, such as lighting, may affect sleep patterns. These changes may then result in negative outcomes such as sleepiness.

Electronic media use and sleep pattern correlations. There was a significant positive correlation between the number of TV's in the home and sleepiness while playing alone. Rationally, a greater number of TV's in the home may indicate a greater propensity towards watching TV. More time spent watching TV is indicative of a more sedentary lifestyle and physical activity is related to sufficient sleep (Foti et al., 2011); therefore, less physical activity may result in less sleep or poorer quality sleep, resulting in greater feelings of sleepiness.

There was also significant positive correlation between sleepiness while watching TV and during computer use. There were significant positive correlations between sleepiness while playing alone and computer use, as well as between sleepiness while playing alone and other electronic use. As discussed earlier, research shows that excessive light exposure from

electronics is in fact associated with sleep deprivation and exhaustion (Tazawa & Okada, 2001). The finding that TV, computer and other electronic media use were associated with sleepiness is consistent with previous research and the bright light theory.

There were significant negative correlations between amount of sleep and computer use; amount of sleep and video game console use; and amount of sleep and other electronic use. These findings reflect those of previous research that shows a negative association between electronic media use and sleep duration (Cain & Gradisar, 2011; Chahal, Fung, Kuhle, & Veugelers, 2013). Dependent on how late their parents allow them to stay up using electronic media, children who use technology might stay up later playing video games, watching movies etc. Additionally, by engaging in activities that cause them to become more alert directly prior to bedtime, they may find it difficult to fall asleep because of physical changes (e.g., exercise before bed changes heart rate, which affects sleep quality; Bulckaert et al., 2011). These changes may then result in either later bedtimes and/or earlier wake times (i.e., shorter sleep duration).

There was also a significant positive relationship between the sleep behaviour subscale and internet use. Because internet use is an interactive activity and engages the brain, depending on the content and when it is used, it may disturb sleep. Researchers have shown that children who watch television at night or those who view more violent content are at an increased likelihood to experience sleep problems (Garrison et al. 2011); therefore, the same may apply to internet use. This finding is consistent with previous research that indicates that any kind of electronic media use directly prior to sleep may cause sleep disturbances (Mesquita & Reimao, 2010). However, because the current study was unable to use the item that asked about when the child typically watched TV and did not explore the content of electronic media use, future research is necessary to investigate this proposition.

Alternatively, if their minds are engaged in an activity and “racing” before bed, children may be more likely to have vivid dreams that affect their sleep quality. For example, Gackenbach (2009) found that electronic media use was associated with lucid dreams (i.e., where the dreamer is aware he or she is dreaming while asleep). Lucid dreams are partially characterized by wakefulness (Tang, Sharma, & Whyte, 2006); therefore, children may not enter as deep a sleep as normal and may be more sensitive to their surroundings (e.g., noises) following the use of engaging electronic media before bed and, as a result, receive poorer quality sleep.

However, there was an unexpected significant negative relationship between the waking during the night subscale and video game console use. The unusual finding that more video game console use was related to fewer and shorter awakenings during the night may be an arbitrary finding due to too small of a sample of children who used a video game console. Only two parents in the study indicated that their child used a video game console. Therefore, the sample is too small to hypothesize about or generalize this finding. A future study with a larger sample of video game console users in this age group is necessary before any conclusions are made.

Electronic media use intercorrelations. There were significant positive correlations between the amount of TV watched and the number of TV’s in the home; amount of TV watched and video game console use; amount of TV watched and other electronic use; and amount of TV watched and the number of nights TV/movies are watched with the family. There was a significant positive correlation between the number of TV’s in the home and other electronic media use. There was a significant positive correlation between the number of minutes of internet used daily and the number of minutes of computer used daily. There were significant positive correlations between the number of minutes of computer used daily and number of

minutes of video game console used daily and between number of minutes of computer used daily and number of minutes of other electronic media used daily. Finally, there was a significant positive correlation between number of minutes of video game console used daily and number of minutes of other electronic media used daily. These results are consistent with other researchers who have found that technology users tend to use multiple electronics (e.g., Granich, Rosenberg, Knuiman, & Timperio, 2011) and those who have found other associations between electronic use (e.g., that electronic media use at one time predicts electronic media use at a later time; Chesley, 2006). For example, Chesley (2006) found that individuals who used technology tended to use both computer-based technology (e.g., internet) and communications-based technology (e.g., cell phone) and that couples living together could influence each others' use of electronics.

Parenting styles are associated with children's behaviours and sleep disruptions (Owens-Stively et al., 1997) and, as one example, researchers have shown a relationship between permissive parenting and increased television viewing among children. Permissive mothers allow their children to watch more than 4 hours of TV each day and they are 5 times more likely than authoritative parents to allow their children to watch this much television in one day (Jago et al., 2011). Therefore, one possibility is that the multiple significant associations between electronic media uses could be a result of permissive parenting and parents that are comfortable allowing their children to use technology more copiously. Technology is an integral component of everyday life for many individuals and, based on electronic media usage patterns, it appears likely that parents who are proponents of electronic media use, especially those who have a permissive parenting style, could influence their children to also adopt their electronic media use habits; however, future research is necessary to explore this speculation.

Behaviour correlations. There were significant positive correlations between the amount of TV watched and all three behaviour dimensions (i.e., Hostile-Aggressive, Anxious-Fearful and Hyperactive-Distractible). Previous researchers have shown that heavy television viewing is associated with symptoms of depression, anxiety and violent behaviour in young children (Singer, Slovak, Frierson, & York, 1998). By spending more time in front of a TV, children are spending less time socializing with others. If they are spending less time in social environments, children may become more anxious and fearful of others because social withdrawal is associated with impairments in cognitive, language, and social development, as well as with difficulties in communication (Milne, Greenway, Guedenay, & Larroque, 2009). Because the toddler and preschool years are highly sensitive periods of development, more time spent alone in front of a TV may affect how a child relates to others.

For example, Coats and Feldman (1995) studied the relationship between the TV viewing habits and nonverbal behavioural encoding skills (i.e., the ability to identify emotions and mimic facial expressions) of children grades 2 through 6 and found significant differences in encoding skills between children who frequently watched TV and those who did not. Specifically, heavy TV watchers were better able to encode emotions often portrayed on TV (i.e., happiness and sadness) than infrequent TV watchers and infrequent TV viewers were better able to identify the emotions less frequently portrayed on TV (i.e., disgust and fear/surprise). The ability to recognize and understand emotions affects how we react to others, thus impacting our behaviour (for example, if we interpret someone's behaviour as hostile, we may either avoid that individual or become more hostile ourselves as a result). Consequently, children that view more TV may be exposed to certain content that is related to the behaviours measured by this study and TV viewing could possibly affect how these behaviours were learned.

Preschool aged children learn through a myriad of ways and modeling behaviour is one of those methods; they rely on others to learn what acceptable behaviour may be. Many TV programs that are directed at children, and appear harmless on the surface, may actually discretely teach different types of aggression. For example, Martin and Wilson (2012) studied the relationship between social aggression portrayed on television and aggressive behaviour in the classroom in a sample of 500 children in grade kindergarten through grade 5 and found a significant positive correlation between social aggression on TV and greater social aggression in females. Sex differences in TV viewing habits may also contribute to sex differences in learned behaviours.

The finding that TV viewing was associated with the Hyperactive-Distractible factor is consistent with some previous research that indicates a relationship between hyperactivity/inattention and higher levels of TV viewing (Ebenegger et al., 2012). However, because multiple regression analyses in the current study did not predict behaviour from electronic media use, and there are studies that did not find evidence for such a relationship (e.g., Stevens, Barnard-Brak, & To, 2009), it is possible that instead of TV increasing hyperactive and distractible behaviours, it may be that children who are more hyperactive and distractible watch more television (Miller et al., 2007).

Miller et al. (2007) recruited 170 preschool children who were divided into a control group of children exhibiting three or fewer ADHD symptoms and an experimental group at-risk of developing ADHD who exhibited six or more hyperactive/inattentive symptoms as rated by parents and teachers. They then gathered information on TV exposure and TV viewing habits via a semistructured interview. They used both teacher reports and actigraphs to more accurately measure children's activity level. The multiple regression analyses revealed a statistically

significant relationship between TV viewing and inattention and hyperactivity in preschool children. The authors' study was based on a former study that also produced similar results and they concluded that, taken together, a relationship between TV viewing and behavioural difficulties similar to that of ADHD does exist. However, the study was unable to infer causation; it remained unclear whether increased levels of TV viewing caused inattentive and hyperactive behaviour or whether hyperactive/inattentive children watch more TV than other children (for example, because they are more difficult to parent and TV is used as a method to occupy them; Miller et al.). In line with Miller et al.'s hypothesis that perhaps hyperactive/inattentive children watch more television, it remains possible that there was also a positive correlation between the number of TV's in the home and hyperactive-distractible behaviour because parents of hyperactive/distractible children might own multiple televisions so that they can occupy their children while still having televisions free of use if others would like to watch them. This may be an interesting hypothesis to examine in future studies.

There was also a positive correlation between the number of minutes a nighttime waking lasts and the Anxious-Fearful factor. This finding is consistent with previous research that shows sleep difficulties are associated with higher levels of anxiety (Hjelde Hansen, Skirbekk, Oerbeck, Wentzel-Larsen, & Kristensen, 2014; Jackson, Sztendur, Diamond, Byles, & Bruck, 2014; Kelly, 2002; Leahy & Gradisar, 2012). Additionally, disruptions to sleep (such as longer nighttime awakenings) can lead to sleep deprivation, which increases vulnerability to stress and amplifies neural responses following stressful events via the amygdala (the brain's fear centre) and appears to heighten one's sensitivity to threat (Goldstein et al. 2013).

Multiple Regressions

Overall, a total of 19 multiple regressions were performed to explore whether electronic media use and sleep patterns would predict behavioural outcomes. Regardless of whether all sleep and electronic media use variables were used as the predictor variables either separately or combined, the results showed no statistically significant findings, despite significant correlations between electronic media use, sleep patterns and behaviour. Even when only using the three most important items from those measures in predicting behaviour, the results still did not yield any statistically significant findings. In addition, MR analyses examined whether electronic media use predicted sleep patterns; there were no statistically significant findings. However, one trend approaching significance will be discussed.

Although the current study showed some support for the relationship between sleep patterns and behaviour (specifically, that longer nighttime awakenings were related to anxious-fearful behaviours), multiple regression analyses did not show that sleep patterns combined predicted any of the three behaviours. Additionally, when only using three variables in the predictor list (i.e., the waking during the night mean, bedtime mean and sleep behaviour mean) the results still did not show that sleep patterns were able to predict any behaviour. One possibility is that children who are more anxious and fearful tend to have poorer quality sleep (e.g., nighttime awakenings). For example, Geng, Fan, and Zhang (2012) found that anxiety associated with negative life events accounts for a large portion of variance in predicting sleep quality. Therefore, it may be that behaviours and environmental factors interact to predict sleep patterns.

Additionally, the MR results did not show that either electronic media use combined or reduced to three in the predictor list (i.e., average number of hours of watching TV daily, average number of hours using a computer daily and average number of hours using other electronic

media daily) predicted any of the three behaviours. The multiple regressions that used only the three electronic media variables in the predictor list did not predict sleep patterns either. Finally, the multiple regression using all sleep patterns and all electronic media use combined as the predictor variables and behaviour as the outcome variable was also not significant. Again, parenting style may have been a mediating factor between the variables. For example, Johnson and McMahon (2008) investigated the relationship between parenting style and self-regulating behaviour in children. Children who do not learn self-regulating behaviours are more demanding of parental attention at bedtime and are more likely to resist sleep. It appears that an authoritative parenting style, defined by a balance between warmth and control (e.g., limit setting), is the most conducive parenting style for the development of self-regulation and is associated with fewer sleep difficulties in children. They also found that authoritative parents engaged in a smaller amount of interaction with their children at bedtime, which promotes self-regulatory behaviour. Therefore, authoritative parents are more likely to set limits and restrict electronic media use that could affect sleep and behaviour if left unrestricted and help promote self-regulation in their children; an authoritative parenting style is, in fact, associated with fewer behavioural problems in children (Alizadeh et al., 2011). On the contrary, permissive parenting may lead to more electronic media use, sleep difficulties and negative behavioural outcomes.

Although there were no statistically significant findings, there was a trend approaching significance in the multiple regressions that explored the ability of average number of hours of watching TV daily, using a computer daily and using other electronic media daily to predict the Hyperactive-Distractible factor. Average number of hours watching TV daily was the driving force in the trend. If statistically significant, this finding would have been consistent with the positive association found between the amount of TV watched and the Hyperactive-Distractible

factor. Although not statistically significant, the MR finding warrants further exploration as a larger sample may have yielded a statistical significance.

The link between TV viewing and hyperactivity/inattention remains unclear. Foster and Watkins (2010) examined data from a national longitudinal study of 1,159 youth TV viewing habits and concluded that if a link between TV and attention exists, it only occurs at exceptionally high levels of TV watching. Cheng et al. (2010) found that age and exposure time were important mediating factors in the relationship between TV viewing and hyperactive and inattentive behaviour. Specifically, more than 4 hours of television daily was related to behavioural difficulties at 18 months, but not at 30 months. They concluded that there is a link between viewing TV and behaviour and social skills, but that it occurs before the age of 2.

In order to further clarify the relationship between TV viewing and hyperactive/inattentive behaviour, future studies could replicate the current study, but examine whether any associations between these variables exist in children younger than those included in this study (i.e., younger than the age of 2). Additionally, future research should aim to determine whether very heavy electronic media use (> 4 hours of electronic media use daily) relates to behaviour (specifically, inattention and hyperactivity) and examine whether parenting style affects these relationships.

Implications for School Psychology Practice

As previously discussed, researchers have shown a strong association between sleep and both cognitive and behavioural outcomes (Astill et al., 2012). Ravid, Pillar, Afek, Suraiya and Shahar (2009) followed 148 kindergarten students from primary until the end of first grade and found that sleep disturbances apparent in kindergarten predicted failure in first grade. They also found that children who failed first grade had longer mean sleep latencies, more nighttime

awakenings and poorer sleep efficiency than children who had not failed first grade.

Additionally, sleep efficiency was related to children's achievements in reading, writing and math. The results also revealed a negative relationship between sleep quality and intelligence measures. Behaviourally, children who had longer sleep and better quality sleep were rated to be more motivated, to have fewer mood swings and better impulse control than children who had higher rates of sleep disturbances.

Evidently, sleep is an integral component to the optimal functioning of students. Children's sleep can help inform assessments and assist school psychologists in developing appropriate education programs and interventions. The statistically significant correlations found in this study between sleep patterns, electronic media use and behaviour are enough to justify further investigation into the complex relations between the variables explored in this study and for school psychologists to pay closer attention to these factors when working with their clients. Considering the research validating its importance, sleep should be a fundamental component explored in the context of assessment and intervention as well.

School psychologists are in a position to help schools spread awareness of good sleep practices that may then improve academic achievement and behaviour. They can also help to educate parents on how to improve their children's sleep. Schools have in fact begun to implement prevention programs that target sleep (e.g., Cain, Gradisar, & Moseley, 2011). Additionally, research on sleep has helped to inform school policies. For example, some schools have delayed start times in high school due to research that indicates teenagers have delayed sleep phases that cause them to be more tired early in the morning. School psychologists should contribute their knowledge and expertise to policies that may need to take children's normative sleep patterns into account (Buckhalt et al., 2009). School psychologists should also use adequate

methods to assess sleep difficulties in order to provide better recommendations and interventions.

Furthermore, because technology is now a fundamental component of education and often used in classrooms by students, it will be important to continually explore the impact of electronic media use on child development and functioning. If school psychologists are to make informed recommendations, they should be aware of potential risks associated with using technology.

Limitations and Future Directions

Because previous research has underscored the importance of length of time of television viewing as an important determinant in sleep patterns and behaviour, specifically between 2 to 4 hours, the current study may have lacked a large enough sample of children who are regular, heavy electronic media users to detect significant relationships between the variables of interest. For example, the amount of time children in the study were reported as watching TV daily ranged between no TV at all to 3 hours, with only approximately 11% watching 2 hours of television daily and 4% watching more than that. It would be interesting to replicate this study with a larger sample of heavy electronic media users in future research.

Additionally, another possibility is that teachers were not yet familiar enough with children to accurately rate them on the behaviour measure. Much of the data was collected at the beginning of the school year and length of time that the rater had known the child was not analyzed. The PBQ is a valid and reliable instrument when raters are somewhat familiar with the child (Behar & Stringfield, 1974). Future studies that explore the relationship between sleep patterns, electronic media use and behaviour would be wise to account for how familiar the raters are with the children. Unfortunately, due to difficulties in the length of time it would take to

collect the data and complete program requirements, it was not feasible to solely collect data during a time of year when teachers would have been better familiar with the children they were rating. The current study would have been strengthened by objective measures of sleep and behaviour, such as the use of actigraphs and behavioural observations.

Most importantly, there are, in all probability, a plethora of factors that may mediate any possible relationships between sleep, electronic media use and behaviour that warrant further study. For example, parenting style would, presumably, greatly affect the relationship between these variables. Family factors and processes, such as parenting style, can predict sleep problems over time. For example, studies indicate that parent-child interactions are predictive of child sleep difficulties. Specifically, children are at a greater risk of developing disturbed sleep patterns when parents are insensitive in their interactions with their children, when they are negatively emotional, and when they report less closeness and more conflict in their lives (Bell & Belsky, 2008). Children who lack self-regulating behaviours are more demanding of parents at bedtime and are more likely to resist sleep; authoritative parenting style appears to be the most conducive parenting style for the development of self-regulation (Johnson & McMahon, 2008). Additionally, the risk of watching more than 4 hours of TV a day is greater for children of permissive parents (Jago et al., 2011). Therefore, parenting style should contribute to the amount of electronic media that children use, as well as sleep patterns and behaviour.

Conclusion

The results of the current study substantiated previous research that shows correlational relationships between electronic media use, sleep patterns and behaviour; however, multiple regression analyses did not show that sleep and electronic media use was associated with children's behaviour. The relationships among these variables could be important in future

research; and additional findings to corroborate and augment those of the current study may affect how school psychologists practice. Since technology is now an integral component of education, any research that helps to further elucidate its risks and merits will be beneficial to the practice of school psychology. At the very least, the current study has drawn some supplementary attention to sleep and electronic media use in a very young age group and has prompted new questions about how these variables relate to development and behaviour in preschool aged children.

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Footnotes

¹Missing values: sex – (1); age – 1; BSHQ – (1); SCSHQ0 – (2); WCSHQ4 – (13); MCSHQ0 – (4); MCSHQ12 – (6); MCSHQ13 – (11); MCSHQ14 – (7); MCSHQ15 – (6); EMUQ1 – (1); EMUQ2 – (2); EMUQ3 – (1); EMUQ4 – (2); EMUQ5 – (1); EMUQ8 – (2); EMUQ9 – (2); EMUQ10 – (3); Hostile-Aggression factor – (1).

Appendix A

Child's Sleep Habits Questionnaire
(Preschool and School-Age)
(Owens, Spirito, & McGuinn, 2000)

Child's Sex: _____ Child's Age: _____

Relationship to the Child (e.g., mother, father, step-parent): _____

The following statements are about your child's sleep habits and possible difficulties with sleep. Think about the **past week** in your child's life when answering the questions. If the last week was unusual for a specific reason (such as your child had an ear infection and did not sleep well), then choose the most recent typical week. Answer **USUALLY** if something occurs **5 or more times** in a week; answer **SOMETIMES** if it occurs **2-4 times** in a week; answer **RARELY** if something occurs **never or 1 time** during a week. Also, please indicate whether or not the sleep habit is a problem by circling "Yes," "No," or "Not Applicable (N/A)."

BEDTIME

Write in child's bedtime: _____

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem? Yes No N/A
Child goes to bed at the same time each night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child falls asleep within 20 minutes after going to bed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child falls asleep alone in own bed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child falls asleep in parent's or sibling's bed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child falls asleep with rocking or rhythmic movements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child needs special object to fall asleep (doll, special blanket, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child needs parent in the room to fall asleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child is ready to go to bed at bedtime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child resists going to bed at bedtime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child struggles at bedtime (cries or refuse to stay in bed, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child is afraid of sleeping in the dark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child is afraid of sleep alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A

SLEEP BEHAVIOR

Child's usual amount of sleep each day: _____ hours and _____ minutes (Please combine night-time sleep and naps)

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem? Yes No N/A
Child sleeps too little	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child sleeps too much	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child sleeps the right amount	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child sleeps about the same amount each day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child wets the bed at night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child talks during sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child is restless and moves a lot during sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child sleepwalks during the night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child moves to someone else's bed during the night (parent, brother, sister, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child reports body pains during sleep. If so where?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
<hr/>				
Child grinds teeth during sleep (your dentist may have told you this)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child snores loudly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child seems to stop breathing during sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child snorts and/or gasps during sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child has trouble sleeping away from home (visiting relatives, vacation)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child complains about problems sleeping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child awakens during night screaming, sweating, and inconsolable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child awakens alarmed by a frightening dream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A

WAKING DURING THE NIGHT

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem? Yes No N/A
Child awakes once during the night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child awakes more than once during the night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child returns to sleep without help after waking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A

Write the number of minutes a night waking usually lasts: _____

MORNING WAKING

Write in the time of day child usually wakes in the morning: _____

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem?
Child wakes up by him/herself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child wakes up with alarm clock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Childs wakes up in negative mood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Adults or siblings wake up child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child has difficulty getting out of bed in the morning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child takes a long time to become alert in the morning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child wakes up very early in the morning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child has a good appetite in the morning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child naps during the day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child suddenly falls asleep in the middle of active behavior	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A
Child seems tired	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes No N/A

During the past week, has your child appeared very sleepy or fallen asleep during the following (check all that apply):

	<u>Not Sleepy</u>	<u>Very Sleepy</u>	<u>Falls Asleep</u>
Play alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Watching TV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Riding in car	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating meals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix B

Electronic Media Use Questionnaire

(adapted from Adachi-Mejia et al., 2007 and Brunborg et al., 2011)

Please answer the following questions.

Television-viewing habits

- On average, how many hours a day does your child watch television? _____
- Does your child have a TV in his or her bedroom that he or she can watch television or movies on? (Yes/No).
- How many televisions do you have in your home? _____
- Does your child usually watch TV or movies before school/after school/after supper? _____
- On average, how many nights per week does your family watch television or movies together? _____

Computer use

- Do you have internet access at home (Yes/No)? If yes, how often does your child use the internet at home? _____
- On average, how many hours a day does your child use a computer? _____
- On average, how many hours a day does your child use a video game console?

- On average, how many hours a day does your child listen to music/the radio?

- On average, how many hours a day does your child use other electronic media (e.g., cell phone)? (please specify type)

Thank you for taking the time to fill out this questionnaire.

	Doesn't Apply	Applies Sometimes	Certainly Applies	For Scorer's Use Only			
10. Has twitches, mannerisms, or tics of the face and body	___	___	___	___	___	
11. Bites nails or fingers	___	___	___	___			
12. Is disobedient	___	___	___	___	..	___	
13. Has poor concentration or short attention span	___	___	___	___	___
14. Tends to be fearful or afraid of new things or new situations	___	___	___	___	___	
15. Fussy or over-particular child	___	___	___	___	___	
16. Tells lies	___	___	___	___	..	___	
17. Has wet or soiled self this year	___	___	___	___			
18. Has stutter or stammer	___	___	___	___			
19. Has other speech difficulty	___	___	___	___	___	
20. Bullies other children	___	___	___	___	..	___	
21. Inattentive	___	___	___	___	___
22. Doesn't share toys	___	___	___	___	..	___	
23. Cries easily	___	___	___	___	___	
24. Blames others	___	___	___	___	..	___	
25. Gives up easily	___	___	___	___	___	
26. Inconsiderate of others	___	___	___	___	..	___	
27. Unusual sexual behaviors	___	___	___	___			
28. Kicks, bites, or hits other children	___	___	___	___	..	___	
29. Stares into space	___	___	___	___	___	
30. Do you consider this child to have behavior problems?	___	___	___	___			
TOTALS				Total	1	2	3

*Appendix D***Parent/Guardian Invitation to Participate**

Dear Parent/Guardian,

My name is Victoria Klimek and I am a 2nd year student in the Master of Arts in School Psychology program at Mount Saint Vincent University in Halifax, NS. I would like to invite you to participate in a study being conducted for my Master's thesis. I am interested in examining the relationship between electronic media use, sleep and behaviour in young children. If you agree to participate in this study, you will be asked to complete two questionnaires that take 15-20 min to complete. They will ask you about your child's general sleep and electronic media use (e.g., TV and computer use). If you agree to participate, your child's teacher will also complete a short corresponding behaviour questionnaire that describes typical childhood behaviours. All responses will be kept confidential.

The benefit of participation in this study is that you will be making a contribution to science. Additionally, your child's classroom will also receive a free children's book to acknowledge my gratitude for your participation. There are no known risks associated with participation in this study; it has been reviewed by, and received ethics clearance through the University Research Ethics Board of the Graduate Studies Department at Mount Saint Vincent University. Your participation is completely voluntary and you may withdraw your permission at any time. Also, if there are any questions that you do not wish to answer, you may leave those questions blank.

If you have any concerns regarding the privacy of the data we are collecting, please know that only my supervisor and I will have access to it. The data will only be used for my thesis project and it will be kept locked away until it is ready to be destroyed once the study is complete. You should not write your name on any part of the questionnaires. If you agree to participate, please sign both copies of the consent form, one for us and one for you to keep. Once you have completed both questionnaires please return them and one signed consent form to your child's teacher in the provided envelope. *Please see the attached information sheet for further details.*

Thank you in advance for your time and consideration.

Sincerely,

Victoria Klimek, B.A.
Graduate Student
Master of Arts in School Psychology
Mount Saint Vincent University

*Appendix E***Parent Information Sheet for Informed Consent**

Mount Saint Vincent University
Department of Education

Title of the Study: Just Five More Minutes Please: An Examination of the Relationship between Electronic Media Use, Sleep and Behaviour in Young Children

Name of Researcher: Victoria Klimek, [REDACTED]

Name of Faculty Supervisor: Dr. Daniel Séguin, [REDACTED]

What is the Study About?

This study is part of my Master of Arts in School Psychology; I am interested in looking at whether electronic media use (such as TV, computer, video games etc.) relates to sleep and behaviour in very young children.

What Will I be Expected to Do and How Much Time Will it Take?

You will be asked to complete two questionnaires, one about your child's sleep and another about your child's use of electronic media. These should take from 15 to 20 minutes to complete.

Will Anyone Know What I Said or Did?

No, all information collected will be confidential. No identifying information will be included in any document from this study. Consent forms will be kept separate from questionnaires and data to assure anonymity. Information based on the results of the group, not individuals, of participants will be reported (e.g., in psychology classes, conferences, written articles).

What Happens If I Change My Mind and Wish to Withdraw?

Your participation is completely voluntary. You can withdraw from the study at any time by contacting the researcher, Victoria Klimek, by telephone [REDACTED] or by e-mail at [REDACTED]. If there are any questions in the questionnaires that you do not wish to answer, you can leave them blank. If you choose to withdraw from the study, any data collected from you up to that point will be destroyed.

What are the Potential Benefits and Risks Associated with Participation in the Study?

Benefits include making a contribution to science and perhaps gaining useful knowledge about your child. There are no known risks in participating in this study.

Where Do I Get Questions Answered?

You may contact me, the researcher or my supervisor (Dr. Daniel Séguin) at any time using the contact information provided in this information sheet. Additionally, after completing questionnaires you will be given a letter that includes contact information for the researcher and supervisor in case you have any other questions at a later time.

This study has been reviewed by, and received ethics clearance through the University Research Ethics Board of the Graduate Studies Department at Mount Saint Vincent University. If you have questions about how this study is being conducted and wish to speak with someone not involved in the study, you may contact the Vice Chair of the University Research Ethics Board, Dr. Sara King at [REDACTED]

Signature of researcher

Signature of Faculty supervisor

Victoria Klimek

Dr. Daniel Séguin

*Appendix F***Parent Consent form**

Just Five More Minutes Please: An Examination of the Relationship between
Electronic Media Use, Sleep and Behaviour in Young Children
Mount Saint Vincent University
Department of Education

Researcher: Victoria Klimek
Faculty Supervisor: Dr. Daniel Séguin

I have received a copy of the Invitation to Participate and Information Sheet for Informed Consent for the research project titled *Just Five More Minutes Please: An Examination of the Relationship between Electronic Media Use, Sleep and Behaviour in Young Children*. I have had an opportunity to read the information provided, or it has been explained to me, and any questions that I had have been answered.

I agree to participate in this research project, understanding that I am doing so voluntarily, that any identifying information will be kept confidential, and that I have the right to stop participating in the study at any point. I agree to complete two questionnaires about my child's sleep and electronic media use (e.g., TV and computer) and to have my child's teacher complete a behaviour questionnaire about my child under the understanding that all responses will be kept anonymous.

Name

Signature

Date

If you are interested in receiving the results of this study, please indicate so below:

Yes, I would like to receive the results of this study. The results can be e-mailed to the following address _____.

No, thank you. I am not interested in receiving the results of this study.

*Appendix G***Teacher Invitation to Participate**

Dear Teacher,

My name is Victoria Klimek and I am a 2nd year student in the Master of Arts in School Psychology program at Mount Saint Vincent University in Halifax, NS. I am contacting you in the hopes that you will agree to participate in a study being conducted for my Master's thesis. My supervisor and I are interested in examining the relationship between electronic media use, sleep and behaviour in young children. Parents who agree to participate in this study will be asked to complete two questionnaires about their child's sleep and electronic media use. If you consent to participate in this study, you will be asked to complete one behaviour questionnaire for each student whose parents consent to participate in the study. You may complete questionnaires at your own convenience and each will take approximately 5 minutes to complete. The questionnaire is a standardized questionnaire that describes typical preschool behaviours. All responses will be kept anonymous.

The benefit of participation in this study is that you will be making a contribution to science. Additionally, you will receive a free children's book for your classroom to acknowledge my gratitude for your participation in this study and your name will be entered into a draw to win a gift card to Staples Business Depot. There are no known risks associated with participation in this study. This study has been reviewed by, and received ethics clearance through the University Research Ethics Board of the Graduate Studies Department at Mount Saint Vincent University. Your participation is completely voluntary and you may withdraw your permission at any time during the study without penalty. Also, if there are any questions that you do not wish to answer, you may leave those questions blank.

If you have any concerns regarding the confidentiality of the data we are collecting, please know that only my supervisor and I will have access to it. The data will solely be used for my thesis project and it will be kept locked away until it is ready to be destroyed once the study is complete. You should not write your name or the student's name on any part of the questionnaires. If you agree to participate please sign both copies of the consent form, one for us and one for you to keep. Each time a parent returns an envelope, please attach a completed behaviour questionnaire for that student to the envelope. Once you have completed questionnaires for all participating students please leave the questionnaires and one signed consent form in a designated area for me to pick-up. I will retrieve questionnaires periodically. *Please see the attached information sheet for further details.*

Thank you in advance for your time and consideration.

Sincerely,

Victoria Klimek, B.A.
Graduate Student
Master of Arts in School Psychology
Mount Saint Vincent University

*Appendix H***Teacher Information Sheet for Informed Consent**

**Mount Saint Vincent University
Department of Education**

Title of the Study: Just Five More Minutes Please: An Examination of the Relationship between Electronic Media Use, Sleep and Behaviour in Young Children

Name of Researcher: Victoria Klimek, [REDACTED]

Name of Faculty Supervisor: Dr. Daniel Séguin, [REDACTED]

What is the Study About?

This study is my thesis that I am completing as part of my Master of Arts in School Psychology under the supervision of Dr. Daniel Séguin. In this study we are interested in looking at how electronic media use relates to sleep and behaviour in very young children.

What Will I be Expected to Do and How Much Time Will it Take?

Parents will be asked to complete two questionnaires about their child's sleep and electronic media use. You will be asked to send these questionnaires home with students. We are also asking that you complete a corresponding standardized behaviour questionnaire for each student whose parents agree to participate in the study; the questionnaire takes approximately 5 minutes to complete. We would ask that you please attach a completed behaviour questionnaire to each envelope returned by a parent.

Will Anyone Know What I Said or Did?

All information collected will be strictly confidential and your name will never be used. No identifying information will be included in any document resulting from this study. Consent forms will be kept separate from questionnaires and data to assure anonymity in this study. Information based on the results of the entire group of participants will be provided to the university and to you upon your request. We may also report the results of our study to psychology classes, conferences, and in written articles.

What Happens If I Change My Mind and Wish to Withdraw?

Your participation is completely voluntary. You may decide to withdraw from the study at any time by contacting the researcher, Victoria Klimek, by telephone [REDACTED] or by e-mail at [REDACTED]. If there are any questions in the questionnaires that you do not wish to answer, you may leave those questions blank. If you choose to withdraw from the study, any data collected from you to that point will be destroyed.

What are the Potential Benefits and Risks Associated with Participation in the Study?

Benefits involved with participation in this study are that you will be making a significant contribution to science and you may gain useful knowledge about your student. Additionally, you will receive one free children's book for your classroom and you will be entered into a draw to win a gift card to Staples Business Depot. No risky or hazardous equipment will be used in this research and there are no known risks in participating in this study.

Where Do I Get Questions Answered?

You may contact the researcher or supervisor at any time using the contact information provided in this information sheet. Additionally, following completion of questionnaires you will be given a letter thanking you for your participation in this study. The letter will also include contact information for the researcher and supervisor in case you have any further questions at a later time.

This study has been reviewed by, and received ethics clearance through the University Research Ethics Board of the Graduate Studies Department at Mount Saint Vincent University. If you have questions about how this study is being conducted and wish to speak with someone not involved in the study you may contact the Vice Chair of the University Research Ethics Board, Dr. Sara King at [REDACTED]

Signature of researcher

Signature of Faculty supervisor

Victoria Klimek

Dr. Daniel Séguin

*Appendix I***Teacher Consent form**

Just Five More Minutes Please: An Examination of the Relationship between
Electronic Media Use, Sleep and Behaviour in Young Children
Mount Saint Vincent University
Department of Education

Researcher: Victoria Klimek
Faculty Supervisor: Dr. Daniel Séguin

I have received a copy of the Invitation to Participate and Information Sheet for Informed Consent for the research project titled *Just Five More Minutes Please: An Examination of the Relationship between Electronic Media Use, Sleep and Behaviour in Young Children*. I have had an opportunity to read the information provided, or it has been explained to me, and any questions that I may have had have been answered.

I agree to participate in this research project, understanding that I am doing so voluntarily, that confidentiality will be maintained, and that I have the right to withdraw from the study at any point using the means outlined in the Information Sheet for Informed Consent. I agree to complete one behaviour questionnaire for each child whose parents have consented to participation in this study with the understanding that all responses will be kept anonymous.

Name

Signature

Date

If you are interested in receiving the results of this study, please indicate so below:

Yes, I would like to receive the results of this study. The results can be e-mailed to the following address _____.

No, thank you. I am not interested in receiving the results of this study.

*Appendix J***Letter of Appreciation for Participation**

Thank you very much for participating in the study titled *Just Five More Minutes Please: An Examination of the Relationship between Electronic Media Use, Sleep and Behaviour in Young Children*. Your time and effort are much appreciated. This study has received ethics clearance through the University Research Ethics Board of the Graduate Studies Department at Mount Saint Vincent University. Your participation is completely voluntary. You may still decide to withdraw from the study at any time by contacting the researcher. If you choose to withdraw from the study, any data collected from you up to this point will be destroyed. If you have any questions or concerns about your participation in this study, please do not hesitate to contact the researcher, Victoria Klimek, by telephone at [REDACTED] or her supervisor, Dr. Daniel Séguin, by telephone at [REDACTED] or by email at [REDACTED].

If you are interested in reading more about electronic media use, sleep and/or behaviour in children, I have provided references below:

- Shochat, T., Flint-Bretler, O., & Tzischinsky, O. (2010). Sleep patterns, electronic media exposure and daytime sleep-related behaviours among Israeli adolescents. *Acta Paediatrica (oslo, Norway :1992)*, 99, 1396-400.
- Bates, J. E., Viken, R. J., Alexander, D. B., Beyers, J., & Stockton, L. (2002). Sleep and adjustment in preschool children: Sleep diary reports by mothers relate to behavior reports by teachers. *Child Development*, 73, 62-74. doi:10.1111/1467-8624.00392
- Owens, J., Maxim, R., McGuinn, M., Nobile, C., Msall, M., & Alario, A. (1999). Television-viewing habits and sleep disturbance in school children. *Pediatrics*, 104, 3.

Table 1

Means and Standard Deviations for Males and Females

Variable	n	Males	N	Females
		M (SD)		M (SD)
Sleep patterns				
BSHQ0	26	8.13 (0.63)	24	7.65 (0.67)
SCSHQ0	25	11.19 (0.10)	24	11.18 (1.19)
WCSHQ4	19	9.05 (7.63)	20	6.20 (5.61)
MCSHQ0	24	6.91 (0.74)	23	6.73 (1.25)
MCSHQ12	23	1.09 (0.42)	23	1.00 (0.00)
MCSHQ13	21	1.14 (0.48)	20	1.10 (0.45)
MCSHQ14	22	1.45 (0.80)	23	1.61 (0.84)
MCSHQ15	23	1.00 (0.00)	23	0.98 (0.10)
BTMean	27	1.85 (0.14)	24	1.82 (0.15)
SBMean	27	1.39 (0.16)	24	1.38 (0.12)
WNMean	27	1.65 (0.24)	24	1.78 (0.49)
MWMean	27	1.65 (0.21)	24	1.61 (0.16)
Electronic media use				
EMUQ1	26	49.38 (46.32)	24	47.92 (41.28)
EMUQ3	27	1.67 (1.41)	23	1.74 (1.01)
EMUQ5	27	1.11 (1.19)	23	1.52 (1.53)

EMUQ7	27	1.26 (1.20)	24	0.79 (1.02)
EMUQ 8	26	16.92 (21.36)	23	14.65 (22.77)
EMUQ9	27	0.52 (2.69)	22	2.73 (12.79)
EMUQ10	26	13.65 (19.69)	22	7.59 (17.47)
<hr/>				
Behaviour				
<hr/>				
Hostile-Aggressive	27	1.44 (0.44)	23	1.31 (0.40)
Anxious-Fearful	27	1.60 (0.41)	24	1.34 (0.36)
Hyperactive-Distractible	27	1.75 (0.60)	24	1.55 (0.65)
<hr/>				

Note. BSHQ0 = bedtime; SCHQ0 = amount slept each day; WCSHQ4 = number of minutes night waking lasts; MCSHQ0 = Morning wake time; MCSHQ12 = sleepiness while playing alone; MCSHQ13 = sleepiness while watching TV; MCSHQ14 = Sleepiness while riding in a car; MCSHQ15 = sleepiness while eating meals; BTMean = Bedtime Subscale mean; SBMean = Sleep Behaviour Subscale mean; WNMean = Waking During the Night Subscale mean; MWMean = Morning Waking Subscale mean; EMUQ1 = number of minutes of TV watched daily; EMUQ3 = number of TV's in the home; EMUQ5 = number of nights TV/movies watched with family weekly; EMUQ7 = number of minutes internet used daily; EMUQ8 = number of minutes computer used daily; EMUQ9 = number of minutes video game console used daily; EMUQ10 = number of minutes of other electronic media used daily.

Table 2

Correlations: Age and All Variables

Sleep Pattern Stand-Alone Items								
	BSHQ 0	SCSHQ 0	WCSHQ 4	MCSHQ 0	MCSHQ 12	MCSHQ 13	MCSHQ 14	MCSHQ 15
Age	-.10	-.19	.01	.10	.07	.10	-.20	.19

Mean Sleep Patterns				
	BT Mean	SB Mean	NW Mean	MW mean
Age	-.10	-.19	.01	.10

Electronic Media Use							
	EMUQ 1	EMUQ 3	EMUQ 5	EMUQ 7	EMUQ 8	EMUQ 9	EMUQ 10
Age	.20	.21	.19	.02	.21	.07	.23

Behaviour			
	H/A	A/F	H/D
Age	-.14	.17	.14

Note. BSHQ0 = bedtime; SCHQ0 = amount slept each day; WCSHQ4 = number of minutes night waking lasts; MCSHQ0 = Morning wake time; MCSHQ12 = sleepiness while playing alone; MCSHQ13 = sleepiness while watching TV; MCSHQ14 = Sleepiness while riding in a car; MCSHQ15 = sleepiness while eating meals; BTMean = Bedtime Subscale mean; SBMean = Sleep Behaviour Subscale mean; WNMean = Waking During the Night Subscale mean; MWMean = Morning Waking Subscale mean; EMUQ1 = number of minutes of TV watched

daily; EMUQ3 = number of TV's in the home; EMUQ5 = number of nights TV/movies watched with family weekly; EMUQ7 = number of minutes internet used daily; EMUQ8 = number of minutes computer used daily; EMUQ9 = number of minutes video game console used daily; EMUQ10 = number of minutes of other electronic media used daily; H/A = Hostile-Aggressive; A/F = Anxious-Fearful; H/D = Hyperactive-Distractible.

Table 3

Sleep Pattern Intercorrelations (Within the CSHQ)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. BSHQ0	---	-.09	.07	.14	.28	-.19	.19	-.11	.02	.05	-.12	.37**
2. SCSHQ0	-.09	---	-.50**	.21	-.30*	-.42**	-.29	.02	.18	-.17	.10	-.27
3. WCSHQ4	.07	-.50**	---	-.31	.38*	.22	.39*	-.03	.01	.01	-.19	.21
4. MCSHQ0	.14	.21	-.31	---	.09	.09	.11	.72**	.19	.08	.21	-.23
5. MCSHQ12	.28	-.30*	.38*	.09	---	.66**	.29	.02	.002	.004	-.02	.07
6. MCSHQ13	-.19	-.42**	.22	.09	.66**	---	.47**	.04	-.15	.05	.23	.12
7. MCSHQ14	.19	-.29	.39*	.11	.29	.47**	---	.10	-.18	.02	.28	.13
8. MCSHQ15	-.11	.02	-.03	.72**	.02	.04	.10	---	.17	.11	.27	-.07

9. BTMean	.02	.18	.01	.19	.002	-.15	-.18	.17	---	-.07	-.02	-.15
10. SBMean	.05	-.17	.01	.08	.004	.05	.02	.11	-.07	---	.26	.21
11. WNMean	-.12	.10	-.19	.21	-.02	.23	.28	.27	-.02	.26	---	.09
12. MWMean	.37**	-.27	.21	-.23	.07	.12	.13	-.07	-.15	.21	.09	---

Note. BSHQ0 = bedtime; SCHQ0 = amount slept each day; WCSHQ4 = number of minutes night waking lasts; MCSHQ0 = morning wake time; MCSHQ12 = sleepiness while playing alone; MCSHQ13 = sleepiness while watching TV; MCSHQ14 = sleepiness while riding in a car; MCSHQ15 = sleepiness while eating meals; BTMean = Bedtime Subscale mean; SBMean = Sleep Behaviour Subscale mean; WNMean = Waking During the Night Subscale mean; MWMean = Morning Waking Subscale mean.

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

Table 4

Electronic media use and sleep pattern correlations.

Variable	EMUQ1	EMUQ3	EMUQ5	EMUQ7	EMUQ8	EMUQ9	EMUQ10
1. BSHQ0	-.03	.26	-.15	.25	.07	-.005	.07
2. SCSHQ0	-.25	-.23	-.15	-.17	-.38**	-.32*	-.33*
3. WCSHQ4	.02	.02	-.04	.22	.23	^a ---	.16
4. MCSHQ0	-.07	-.09	-.006	.16	-.002	.02	-.05
5. MCSHQ12	.25	.44**	.08	.26	.31*	-.03	.43**
6. MCSHQ13	.18	.31	-.04	.14	.42**	-.05	.24
7. MCSHQ14	-.15	-.09	.004	.28	.27	-.13	-.08
8. MCSHQ15	.06	-.18	.03	.14	.11	.03	.09
9. BTMean	-.02	-.11	-.03	-.06	-.18	-.04	.04
10. SBMean	.12	.19	.14	.31*	.16	-.03	-.07
11. WNMean	-.11	.08	.03	-.07	-.02	-.31*	-.24
12. MWMean	-.03	.08	-.03	.13	.04	-.05	.003

Note. BSHQ0 = bedtime; SCHQ0 = amount slept each day; WCSHQ4 = number of minutes night waking lasts; MCSHQ0 = morning wake time; MCSHQ12 = sleepiness while playing alone; MCSHQ13 = sleepiness while watching TV; MCSHQ14 = sleepiness while riding in a car; MCSHQ15 = sleepiness while eating meals; BTMean = Bedtime Subscale mean; SBMean = Sleep Behaviour Subscale mean; WNMean = Waking During the Night Subscale mean; MWMean = Morning Waking Subscale mean; EMUQ1 = number of minutes of TV watched daily; EMUQ3 = number of TV's in the home; EMUQ5 = number of nights TV/movies watched with family weekly; EMUQ7 = number of minutes internet used daily; EMUQ8 = number of minutes computer used daily; EMUQ9 = number of minutes video game console used daily; EMUQ10 = number of minutes of other electronic media used daily. ^aCould not be computed because at least one of the variables is constant.

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

Table 5

Electronic Media Use Intercorrelations.

Variable	EMUQ1	EMUQ3	EMUQ5	EMUQ7	EMUQ8	EMUQ9	EMUQ10
EMUQ1	---	.44**	.54**	-.03	.28	.47**	.34*
EMUQ3	.44**	---	.23	-.08	.18	.13	.35*
EMUQ5	.54**	.23	---	-.12	-.04	.19	.08
EMUQ7	-.03	-.08	-.12	---	.58**	-.10	.27
EMUQ8	.28	.18	-.04	.58**	---	.29*	.65**
EMUQ9	.47**	.13	.19	-.10	.29*	---	.38**
EMUQ10	.34*	.35*	.08	.27	.65**	.38**	---

Note. EMUQ1 = number of minutes of TV watched daily; EMUQ3 = number of TV's in the home; EMUQ5 = number of nights TV/movies watched with family weekly; EMUQ7 = number of minutes internet used daily; EMUQ8 = number of minutes computer used daily; EMUQ9 = number of minutes video game console used daily; EMUQ10 = number of minutes of other electronic media used daily.

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

Table 6

Behaviour Correlations.

Variable	Hostile-Aggressive	Anxious-Fearful	Hyperactive-Distractible
BSHQ0	.13	.07	.15
SCSHQ0	.16	-.17	.002
WCSHQ4	.10	.33*	.18
MCSHQ0	-.07	.003	.14
MCSHQ12	-.14	-.01	.04
MCSHQ13	-.18	.04	.004
MCSHQ14	-.09	.06	-.03
MCSHQ15	-.09	.17	.15
BTMean	.04	.13	.11
SBMean	.07	.06	.03
WNMean	-.09	.04	-.03
MWMean	-.08	.23	.11

EMUQ1	.31*	.28*	.33*
EMUQ3	.09	.18	.30*
EMUQ5	.18	.22	.22
EMUQ7	-.09	-.07	-.08
EMUQ8	-.01	.18	-.03
EMUQ9	.26	.17	.27
EMUQ10	.08	.09	.08

Note. BSHQ0 = bedtime; SCHQ0 = amount slept each day; WCSHQ4 = number of minutes night waking lasts; MCSHQ0 = Morning wake time; MCSHQ12 = sleepiness while playing alone; MCSHQ13 = sleepiness while watching TV; MCSHQ14 = Sleepiness while riding in a car; MCSHQ15 = sleepiness while eating meals; BTMean = Bedtime Subscale mean; SBMean = Sleep Behaviour Subscale mean; WNMean = Waking During the Night Subscale mean; MWMean = Morning Waking Subscale mean; EMUQ1 = number of minutes of TV watched daily; EMUQ3 = number of TV's in the home; EMUQ5 = number of nights TV/movies watched with family weekly; EMUQ7 = number of minutes internet used daily; EMUQ8 = number of minutes computer used daily; EMUQ9 = number of minutes video game console used daily; EMUQ10 = number of minutes of other electronic media used daily.

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.