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“Do I Really Need a Nap?”: The Role of Sleep Science in Informing Sleep Practices in Early Childhood Education and Care Settings

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Abstract

A compelling body of studies identifies the importance of sleep for children’s learning, behavioural regulation and health. These studies have primarily focused on nighttime sleep or upon total sleep duration. The independent contribution of daytime sleep, or napping, in childhood is an emerging research focus. Daytime sleep is particularly pertinent to the context of early childhood education and care (ECEC) where, internationally, allocation of time for naps is commonplace through to the time of school entry. The biological value of napping varies with neurological maturity and with individual circumstance. Beyond the age of three years, when monophasic sleep patterns become typical, there is an increasing disjuncture between children’s normative sleep requirements and ECEC practice. At this time, research evidence consistently identifies an association between napping and decreased quality and duration of night sleep. We assess the implications of this evidence for educational practice and health policy. We identify the need to distinguish the functions of napping from those of rest, and assert the need for evidence-based guidelines on sleep-rest practices in ECEC settings to accommodate individual variation in sleep needs. Given both the evidence on the impact of children’s nighttime sleep on long-term trajectories of health and well-being and the high rates of child attendance in ECEC programs, we conclude that policy and practice regarding naptime have significant implications for child welfare and on-going public health.

Keywords: Napping, Sleep, Early Childhood Education and Care, Policy, Practice
“Do I Really Need a Nap?”: The Role of Sleep Science in Informing Sleep Practices in Early Childhood Education and Care Settings

A growing international body of data indicates that many children do not normally have a daily nap after the age of approximately three years (Blair et al., 2012; Carter, Taylor, Williams, & Taylor, 2011; Galland, Taylor, Elder, & Herbison, 2012; Iglowstein, Jenni, Molinari, & Largo, 2003; Komada et al., 2012; Ottaviano, Giannotti, Cortesi, Bruni, & Ottaviano, 1996; Snell, Adam, & Duncan, 2007; Thorleifsdottir, Björnsson, Benediktsdottir, Gislason, & Kristbjarnarson, 2002). In early childhood education and care (ECEC) settings, however, scheduling of a daily nap time and concurrent sleep promotion are commonplace right through until the time children enter school, around age six (El-Sheikh, Arsiwalla, Staton, Dyer, & Vaughn, 2012; Fukuda & Sakashita, 2002; Staton, Smith, Pattinson, & Thorpe, 2014; Ward, Gay, Alkon, Anders, & Lee, 2008). In many centres these nap times are mandatory and of significant duration. We review the extant literature regarding napping within the early childhood period, identify a disjuncture between scientific evidence on children’s sleep needs and current practice in ECEC settings, and outline a research agenda to inform policy. We ask whether, for whom and under what conditions napping in ECEC is important, and in what ways sleep practices in these settings are likely to confer benefit or risk to children, families, and ongoing public health.

In developed economies, a high proportion of parents participate in the workforce, and by the end of the early childhood period most children will have spent some time in a non-parental ECEC setting (OECD, 2014). For example, by four years a majority of children attend ECEC in the USA (57.5%), UK (97.3%), Australia (52.6%) and Japan (95.7%) and attendance rates increase such that by five years the figures for these countries are 73.3%, 98.8%, 99.8% and 98.2% respectively. The extent to which sleep time is a component of the ECEC day across different nations is not systematically documented, however, there is evidence from USA, Japan, Finland and Australia that indicate that scheduled nap times can last up to, and in excess of, two hours (El-Sheikh et al., 2012;
Fukuda & Sakashita, 2002; Staton, Smith, Pattinson, & Thorpe, 2013; Ward, Gay, Alkon, et al., 2008; Watamura, Sebanc, & Gunnar, 2002), which has been defined as a ‘substantial proportion’ of the ECEC day (Harms, Clifford, & Cryer, 2003). Current understanding of the effects of these practices is limited. Studies of nighttime sleep documents a largely positive association between children’s sleep quality and duration and their developmental outcomes (e.g. Alfano & Gamble, 2009; Bates, Viken, Alexander, Beyers, & Stockton, 2002; Bell & Zimmerman, 2010; Carter et al., 2011; Gomez, Newman-Smith, Breslin, & Bootzin, 2011; Jiang et al., 2009; Paavonen, Porkka-Heiskanen, & Lahikainen, 2009; Sadeh, Gruber, & Raviv, 2002; Touchette et al., 2007). Though it is tempting to extrapolate from these findings to infer a universal benefit for daytime sleep, studies of napping in early childhood suggest this inference may be overly simplistic (e.g. Dionne et al., 2011; Fukuda & Asaoka, 2004; Lam, Mahone, Mason, & Scharf, 2011). The extant evidence raises questions about the value of routine scheduling of extended sleep periods for all children in ECEC settings. There is a need to apply the existing evidence from developmental and sleep science to guide appropriate policy and practice in ECEC settings, and a need for further research to refine such guidance. Specifically, there is a growing imperative for evidence to direct an accommodation of individual differences in sleep need that result both from variation in timing of neurobiological maturation and the diversity of social and health circumstance experienced by the population of children who attend ECEC settings.

The Importance of Sleep in Early Childhood

Sleep has a significant impact on how individuals think, feel and behave throughout the life span (Carskadon & Dement, 1994; Vassalli & Dijk, 2009). In regards to early childhood (0-5 years), a large body of data attests to the significance of sleep in promoting a developmental outcomes (Alfano & Gamble, 2009; Bates et al., 2002; Bell & Zimmerman, 2010; Bernier, Beauchamp, Bouvette-Turcot, Carlson, & Carrier, 2013; Cappuccio et al., 2008; Carter et al., 2011; Gomez et al., 2011; Paavonen et al., 2009; Touchette et al., 2007). These studies converge to identify that both the
quantity and quality of sleep are positively associated with children’s concurrent and longer term learning, behaviour and health. For example, shorter sleep duration has been associated with paediatric obesity that has attendant lifetime effects on health and social well-being (Bell & Zimmerman, 2010; Carter et al., 2011; Snell et al., 2007).

The early childhood period is a particularly critical time, during which there is rapid biological transition toward adult patterns of sleep (Touchette, Petit, Tremblay, & Montplaisir, 2009) and, commensurate with this transition, an increasing sensitivity to environmental influence (Dionne et al., 2011; Fisher, van Jaarsveld, Llewellyn, & Wardle, 2012; Touchette et al., 2013). Emerging evidence from studies using animal models suggest that sleep early in life is critical for normal brain development, and that perturbation of sleep within these critical sensitive periods may influence significant later adult behaviour (Kayser, Yue, & Sehgal, 2014). While models such as those by Keyser used drosophila (fruit fly), such models can provide powerful new insights into the mechanisms of sleep’s role in normal development (Sehgal & Mignot, 2011) as they have for other developmental phenomenon (Fernando & Robbins, 2011). Their findings provide support for a critical developmental window in which sleep may determine life-long trajectories, and in which appropriate sleep is necessary.

Normative developmental sleep trajectories during the early childhood period map a process of consolidation of sleep into the nighttime period and a commensurate reduction in daytime sleep (Blair et al., 2012; Dionne et al., 2011; Iglowstein et al., 2003). Over a very short period of approximately four years there is a transition from the polyphasic sleep-wake pattern seen in early infancy, where children sleep at multiple times during the day, to a biphasic sleep/wake pattern where children nap only once and finally a monophasic pattern of a single night sleep, typical of that seen in adults (Figure 1). This transition can be understood as maturation of the circadian processes that underlie sleep timing and that work in concert with the homeostatic need for sleep (Borbély, 1982; Fuller, Gooley, & Saper, 2006). The cessation of day-time sleep during the preschool period
has been postulated to reflect changes in the speed of accumulation of sleep drive, with a faster accumulation in early infancy and a gradual reduction over time (Jenni & Carskadon, 2007; Jenni & Le Bourgeois, 2006). This reduction in sleep drive may be evidenced by an increase in sleep onset latency (time it takes to fall asleep) and a reduced ability to fall asleep during nap times, as well as a decrease in behaviours known to be associated with sleepiness during waking hours (e.g. increased irritability). Understanding of the changing developmental value of daytime sleep across this period of rapid transition is limited. The biologically normative cessation of daytime sleep, however, most likely indicates that habitual napping (i.e. napping as daily routine) is no longer a necessary or developmentally productive event, and points towards differential effects of napping across time.

The Importance of Napping in Early Childhood

Although napping represents a significant characteristic of sleep patterns during the first years of life, there are currently surprisingly few studies on the independent effects of this component of sleep during early childhood (Thorpe et al., 2014). Much of the evidence of the value of napping has come from studies in adult populations (for review see Ficca, Axelsson, Mollicone, Muto, & Vitiello, 2010; Milner & Cote, 2009). Collectively these studies indicate that napping aids neurocognitive functioning; including both declarative and procedural memory, alertness, concentration and mood. While napping in healthy adult populations can confer significant benefits, there is also growing recognition that this relationship is complex and likely moderated by a number of factors, including the timing and duration of the nap, experience with napping, and age (Ficca et al., 2010; Milner & Cote, 2009). In addition, whether napping occurs as a restorative measure following sleep deprivation, as prophylaxis prior to anticipate sleep debt, or under conditions of normal sleep has impact on the nature and magnitude of benefits reported (Milner & Cote, 2009).

A small number of studies have specifically examined the effects of napping on health, behavioural and cognitive outcomes in early childhood (Bell & Zimmerman, 2010; Berger, Miller, Seifer, Cares, & Le Bourgeois, 2012; Boto et al., 2012; Dionne et al., 2011; Gómez, Bootzin, &
Nadel, 2006; Hupbach, Gomez, Bootzin, & Nadel, 2009; Kurdziel, Duclos, & Spencer, 2013; Lam et al., 2011; Lukowski & Milojevich, 2013; Spruyt et al., 2008; Touchette et al., 2008; Valent, Brusaferro, & Barbone, 2001; Yokomaku et al., 2008). With few exceptions (Bell & Zimmerman, 2010; Boto et al., 2012; Dionne et al., 2011; Touchette et al., 2008; Valent et al., 2001), these studies have focused on children within narrow age bands and therefore cannot account for variation in the effects of napping across the dynamic period of early childhood. Consistent with studies of napping in adult populations, these studies suggest a complex picture in which the effects of napping vary by measurement, design and familiarity with napping (i.e. whether a child habitually naps) and, likely, the age of the child.

Studies of napping and health outcomes have focused primarily on two outcomes, risk of paediatric obesity (Bell & Zimmerman, 2010; Touchette et al., 2008) and accident or injury (Boto et al., 2012; Valent et al., 2001). Bell and Zimmerman (2010) and Touchette et al. (2008) both use prospective longitudinal cohort designs to examine the relationship between sleep duration in early childhood and subsequent childhood obesity. Although these studies report an increased risk of overweight or obesity for children with shorter nighttime sleep duration, in both cases no significant effects for day-time sleep were observed. Alternatively, two studies examining accidental injury report higher rates of injury among young children who did not have daytime sleep in the time proceeding presentation at paediatric health services (0-5 years; Boto et al., 2012; Valent et al., 2001). Both studies were based on retrospective parent report of children attending health services who presented (case) and did not present (control) with accidental injury. While the strength of these studies lies in the use of a case-control design, their value is limited by the potential for differential recall bias in the comparison groups, because these reports are non-random and retrospective. These two studies direct attention to the impact of sleep on behavioural and emotional regulation, hypothesising that these are the mechanisms that connect absence of sleep to increased accidental injury.
Studies examining impacts of napping on emotional-behavioural regulation present a more complex picture (Berger et al., 2012; Hall, Scher, Zaidman-Zait, Espezel, & Warnock, 2012; Spruyt et al., 2008; Yokomaku et al., 2008). An experimental study of children, aged 30-36 months, reported poorer emotional regulation when routine napping was restricted (Berger et al., 2012). In contrast, a correlational study of the first year of life (Spruyt et al., 2008) reported increased behavioural regulation associated with naturally occurring decreases in daytime sleep. Similar variation in findings is emerging for cognitive performance. Current evidence suggests an adverse effect on cognitive functioning in habitual nappers, aged < 16 months, under experimental conditions of napping restriction (Lukowski & Milojevich, 2013) or after manipulation of timing of cognitive testing relative to routine nap time (Gómez et al., 2006; Hupbach et al., 2009). In addition, Kurdziel et al. (2013) in a study of children aged three to six years, showed improved memory recall following a nap. This effect was found to be independent of age, but only observed amongst children who habitually napped. This study represents the first and only study, to the author’s knowledge, to use polysomnography to examine the relationship between specific sleep processes and sleep dependent changes during naps in young children. It identified that the density of sleep spindles was associated with memory recall performance. Collectively these experimental studies suggest that, at least amongst children who habitually nap, napping is important for learning.

In contrast, correlational studies of cognitive outcomes in children report a negative association between cognitive functioning and duration of napping (Dionne et al., 2011; Lam et al., 2011). To date, perhaps the most informative study to examine developmental outcomes of sleep consolidation across time is the study of Dionne et al. (2011). This study captures the complexity of the transition across the full period of sleep transition (6 – 60 months) and focuses on longitudinal change in sleep consolidation (with day sleep expressed as a ratio of night sleep) rather than sleep duration alone. The study examined the association of sleep consolidation measured at 6-, 18- and 30- months with language development measured at 18-, 30- and 60- months. They report that, in the first two years of life, children with less mature sleep consolidation, characterised by higher amounts of daytime
sleep as a ratio of total sleep, were at increased risk of language delay at 60 months. This study suggests sleep consolidation is a marker of neurological maturation, and identifies the child’s positioning along the transition from polyphasic to monophasic sleep patterns as critical to understanding the value of daytime sleep. Lam at al. (2011) examined the effects of napping for children, aged three to five years, all of whom were attending full-time childcare. This study used continuous physiological measurement of activity, via actigraphy, to examine the independent effects of both daytime and nighttime sleep duration on cognitive and behavioural outcomes. The findings showed that longer duration of nighttime sleep was positively associated with cognitive function. However, longer duration of daytime sleep was associated with both decreased night sleep and poorer outcomes on cognitive measures. One possible explanation of these findings relates to cognitive maturity, such that the reduction in daytime sleep reflects brain maturation processes and also accounts for more advanced cognitive functioning. An alternative explanation relates to the homeostatic sleep drive. That is, napping may discharge some sleep need, thereby reducing the homeostatic drive and the propensity for nighttime sleep. As a consequence of poor night sleep, cognitive function may be impaired. This explanation aligns with the consistent and growing number of studies that report a negative association between duration of daytime napping and duration and quality of young children’s nighttime sleep (Acebo et al., 2005; Fukuda & Asaoka, 2004; Fukuda & Sakashita, 2002; Jones & Ball, 2013; Komada et al., 2012; Thorleifsdottir et al., 2002; Ward, Gay, Anders, Alkon, & Lee, 2008).

While it is possible that daytime sleep may be compensatory for sleep debt due to shortened and interrupted nighttime sleep patterns as a result of child, family or environmental factors, to date the few studies examining the direction of association between duration of napping and nighttime sleep suggest an alternative direction of effect (Fukuda & Asaoka, 2004; Fukuda & Sakashita, 2002; Komada et al., 2012). Two of these studies (Fukuda & Asaoka, 2004; Fukuda & Sakashita, 2002) compared the sleeping patterns of children who attended Nursery schools, where children were required by the government to have an obligatory afternoon nap of 1.5 hours as part of their daily
routine, to those attending kindergartens where nap periods were optional. Children in Nursery school settings went to bed later and had more sleep related difficulties than children attending kindergartens (Fukuda & Sakashita, 2002). These effects were still observed into the elementary school years, well after the routine of afternoon naps had stopped (Fukuda & Asaoka, 2004). In addition, Fukuda and Sakashita (2002) and, more recently Komada et al. (2012), examined the direction of association with nighttime sleep. Komada et al. (2012) report a significant negative association of napping on subsequent night sleep onset, while Fukuda and Sakashita (2002) report no significant difference in night sleep duration in the preceding night, but significantly later night sleep onset following a daytime nap in ECEC. The results suggest that napping in ECEC settings reduces children’s homeostatic sleep drive, such that children who nap during the day have reduced duration and quality of their nighttime sleep and that this may also establish enduring patterns of nighttime sleep disturbance.

In sum, the current body of evidence, though small, provides sufficient reason to question the benefit of routinely scheduled napping once a child consolidates their sleep into the nighttime period. While environmental factors that reduce quality or quantity of night sleep may be remediated by a nap, in the absence of such difficulties the findings raise the potential that napping can cause disruption to nighttime sleep, a consistent predictor of health and well-being. Concurrently, the evidence also suggests that disrupting napping patterns in children who have not reached monophasic sleep (i.e. children who habitually nap) may also have detrimental effects for learning and behaviour. These findings draw attention to the importance of policies and practices in ECEC settings that both recognise and respond to individual variations in children’s sleep needs.

**The Importance of Sleep in ECEC**

ECEC settings provide a fertile context for understanding daytime sleep patterns and the effects of these patterns on young children. It is therefore not surprising that ECEC settings have been the focus for recruitment for childhood sleep studies. Yet the impact of the ECEC context on
the sleep of children who attend, and the implication for sleep policy and practice within these contexts, is not well addressed in the literature. In the absence of a coherent translation of the evidence base, current practices in ECEC settings vary considerably (El-Sheikh et al., 2012; Fukuda & Sakashita, 2002; Marriott, Staton, Thorpe, Pattinson, & Smith, 2013; Siren-Tiusanen & Robinson, 2001; Staton et al., 2013; Ward, Gay, Anders, et al., 2008; Watamura et al., 2002). There are four key forms of variation. First, some centres have standard scheduled sleep times while others have practices that change in response to perceived needs of different age groups or, more rarely, individuals (Siren-Tiusanen & Robinson, 2001; Staton et al., 2013). In addition, the time allocation for sleep varies in both duration and scheduling. For example, an Australian study of 130 ECEC centres found a range of 0-180 minutes of scheduled sleep time for children aged three to six years with start times ranging from 11.30am -1.30pm (Staton et al., 2014). Second, some centres require all children in a group to lie down without alternatives during sleep times (Fukuda & Sakashita, 2002; Staton et al., 2013; Ward, Gay, Alkon, et al., 2008; Watamura et al., 2002), while others have more flexible practices in which sleep time is optional and alternative activities are provided for non-sleepers (Fukuda & Sakashita, 2002; Staton et al., 2013). Third, some centres employ strategies that align with current evidence on sleep promotion while others provide environments that are incongruent with this evidence (Marriott et al., 2013). Fourth, some centres routinely consult with parents regarding factors affecting their child’s daily sleep requirements (e.g. child health or incidence of sleep disruption), while others maintain standard polices that do not allow such responsiveness (Siren-Tiusanen & Robinson, 2001). Accordingly, in translation of current evidence from sleep science to policy and practice in ECEC settings there are four key questions to consider:

1. Should there be uniform scheduling of naptime for all children?
2. How should the needs of non-nappers be met?
3. How should the needs of nappers be met?
4. How should contextual and individual variations in sleep need be accommodated?
Translation of Evidence to Policy and Practice

1. Should there be uniform scheduling of naptime? ECEC centres can be challenging environments for young children. Attendance involves extended periods of separation from parents, interactions with multiple adults and age peers and often, high levels of activity. Such experiences have been identified as potentially stressful (Vermeer & van Ijzendoorn, 2006). Given this context and the concurrent developmental decline in normative daytime sleep, in ECEC settings there is a strong rationale for the provision of both the opportunity for sleep for those who need it and, for those who no longer sleep, for rest. However, there is a need to clearly distinguish between uniform scheduling of sleep time and flexible opportunity for sleep or rest.

In ECEC centres children are typically grouped across wide age bands (e.g. 0-18 months, 18 months-3 years, 3-5 years). As a consequence there is inevitably considerable variation in sleep need across and within ECEC rooms. This variation pertains not only to duration of napping and age of cessation, but also to the timing of sleep need relative to individual circadian rhythm phases and homeostatic drive. Accordingly, the practice of scheduling fixed time and fixed duration sleep periods within a room or centre is unlikely to be optimal in addressing the sleep needs of all children. The practice of scheduling uniformed sleep times for all children does not address the needs of those who do not require sleep and may not necessarily meet the sleep needs of those who do.

2. How should the needs of non-nappers be met? Collectively, international representative population studies indicate that less than a third of children will habitually nap by age four (e.g. Blair et al., 2012; Iglowstein et al., 2003; Komada et al., 2012; Ottaviano et al., 1996; Snell et al., 2007; Weissbluth, 1995). There is considerable variation in age of cessation with some children ceasing to nap as early as 12 months (Figure 2). This means that there is likely to be a proportion of children in ECEC settings who do not nap, even when opportunities to sleep are provided. Observational studies show this is the case even under conditions of extended mandatory sleep times in which no other activity is permitted (Ward, Gay, Anders, et al., 2008). For non-nappers, scheduling of mandatory sleep time translates to extended periods of restricted activity. While short periods of quiet activity
may serve to provide rest, extended periods of inactivity may not be restful but may instead be experienced as stressful (Pattinson, Staton, Smith, Sinclair, & Thorpe, 2014).

Sleep latency, that is the time it takes to fall asleep once attempting to, of children in the early childhood period is on average between 16-19 minutes (Galland et al., 2012). This finding provides a rationale in ECEC settings for allowing a period of rest on a bed, for at least this duration, to accommodate the needs of children who are in transition from biphasic to monophasic sleep (i.e. sleeping some days and not others). However, for those who do not fall asleep, provision of restful alternative activity may be more appropriate.

3. How should the needs of nappers be met? Studies of night sleep in children identify a range of environmental factors that influence, both positively and negatively, the quality and duration of children’s sleep (Owens, 2004; Touchette et al., 2009). Broadly, these fall into three major categories: the sleep environment (e.g. temperature, light, noise), the behavioural environment (e.g. arousal levels, routines and predictability), and the individual daily context (e.g. diet, physical activity). While there are few studies of the impact of these factors in regards to daytime sleep, it is likely that they are of equal, or potentially greater importance, in the context of supporting sleep in ECEC, where children are required to sleep in a group setting. The body of literature identifies sleep-supporting environments as those that are comfortable, predictable and of low arousal. A recent observational study of sleep practices in ECEC centres reported that while all centres provided a sleep time, only a minority (39%) provided environments that aligned with evidence on sleep supporting behaviour (Marriott et al., 2013). While opportunity to sleep was provided in many centres, opportunity for undisrupted or high quality sleep was not. Given the existing evidence highlighting the negative impact of disruptions to habitual napping (Berger et al., 2012; Lukowski & Milojevich, 2013), the provision of environments that mitigate against disruption for children who require sleep is significant. These findings direct attention to the need for evidence-based practice guidelines and professional development of early childhood educators in facilitating sleep health.
4. How should contextual and individual variation in sleep need be accommodated?

Children attending ECEC settings come from a diversity of family contexts and bring with them a range of individual characteristics and circumstances that may affect their sleep need. A substantial body of studies documents family, individual and social-environmental factors that are associated with children’s sleep patterns and problems (Figure 3; Iwata, Iwata, Iemura, Iwasaki, & Matsuishi, 2011; Owens, 2004; Touchette et al., 2009). Most of these studies relate to night sleep, however, disrupted night sleep may increase the need for restorative day sleep in some children.

A consistently reported finding is an association between family characteristics and circumstance, including socio-economic status (Acebo et al., 2005; Arman et al., 2011; Hale, Berger, LeBourgeois, & Brooks-Gunn, 2009), parent age (Sadeh, Raviv, & Gruber, 2000), parent education (Blair et al., 2012; Hale et al., 2009; Sadeh et al., 2000), family structure (Blair et al., 2012; Hale et al., 2009) and racial or ethnic background (Blair et al., 2012; Crosby, LeBourgeois, & Harsh, 2005) with children’s sleep patterns. These factors may be chronic or acute. For example, family stress (Sadeh et al., 2000) and constraints due to work and lifestyle arrangements (Iwata et al., 2011) can have an on-going impact on family functioning and parent’s ability to support optimal night sleep, or may have a strong but transient effect. The research highlights the potential for complex and significant variation in sleep need across context and time, and directs attention to the significance of on-going communication about daily sleep need between ECEC practitioners and families. More importantly, there is an imperative for sleep practices that allow appropriate response to changing individual sleep needs due to environmental constraints.

Extremes of variation in sleep patterns can also be a marker of underlying developmental and neurocognitive disorder and pathology (for review see Alfano & Gamble, 2009; Owens & Witmans, 2004; Touchette et al., 2009). The co-morbidity of sleep disruptions with a wide range of disorders, including attention deficit hyperactivity disorder, anxiety disorders, autism and depression has been well documented. For examples, studies have shown significant variations in both daytime
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(Schwichtenberg, Iosif, Goodlin-Jones, Tang, & Anders, 2011) and nighttime (Anders, Iosif, Schwichtenberg, Tang, & Goodlin-Jones, 2011) sleep patterns across a six month period for children with autism spectrum disorders or developmental delay, when compared to matched typically developing controls. Children’s health status, including transitory infection and more serious health conditions, may also affect sleep need and sleep patterns (Newman, O'Regan, & Hensey, 2006; Stein, Mendelsohn, Obermeyer, Amromin, & Benca, 2001). Again, these variations among children highlight the critical role of parent-practitioner communication regarding sleep need. Additionally, the ECEC environment may be an important setting for observation of behaviours, including sleep behaviours, which may contribute to diagnoses of pathologies, early intervention and ongoing management.

Providing Evidence Based Policy and Practice

Sleep is undoubtedly an important biological process that has broad ranging impacts on human functioning throughout the life span (Carskadon & Dement, 1994; Vassalli & Dijk, 2009). Given that there is strikingly little evidence concerning the impacts of daytime sleep and that the scheduling of nap-time is commonplace in ECEC settings, a focus on sleep practices in this context presents a critical direction for ongoing research. The variation in sleep practices across centres affords opportunity to explore the interface of biological and environmental effects. Considering the large number of children attending ECEC (OECD, 2014), and the current diversity of practices pertaining to sleep within these settings (El-Sheikh, Buckhalt, Keller, & Granger, 2008; Fukuda & Sakashita, 2002; Siren-Tiusanen & Robinson, 2001; Staton et al., 2014), there is an imperative to address the large gap in research evidence on the effects of napping. How napping affects development, and specifically the contribution of napping within the ECEC context is largely unknown. Accordingly, we propose four key directions for investigation.

First, further studies are needed to examine the independent effects of napping on development across the early childhood period. Given the documented dramatic transition of sleep
patterns across early childhood, these studies must include examination of the potential differential effects of daytime sleep periods for children of different ages that are tracked across time. To fully understand the independent effects of napping, detailed attention to developmental milestones and context is essential because these are key indices of biological and environmental influences. Studies must include both experimental and naturalistic approaches to disentangle the effects of perturbation of sleep patterns and those of naturally occurring biological and environmental variation. Finally, to improve our understanding of sleep architecture and other neuropsychological aspects of napping in young children methodologies that include the use of polysomnography and other objective measures of sleep and neurophysiological functioning should be employed.

Second, studies must examine the influence of practices in ECEC services on developmental patterns of sleep. Studies are particularly needed that focus on the effects of enforcing daytime sleep periods for children who have transitioned away from a biphasic sleep pattern. Identification of specific characteristics of ECEC settings that may influence sleep quality and duration is also required. While we know that a range of factors in the home environment influence children’s sleep (Iwata et al., 2011; Owens, 2004; Touchette et al., 2009), currently we do not understand the effect of equivalent factors in ECEC environments.

Third, studies must consider the effects of current sleep practices in early childhood services on children’s immediate and long-term health, well-being and development. Longitudinal studies that track effects across time and allow modelling of pathways from sleep to child development outcomes are required. In Figure 4 we propose a range of theoretical mechanisms that warrant exploration, that implicate both biological and social pathways. Physiological and observational measurement of sleep, stress and environment in addition to more common parental report approaches is important in providing a comprehensive investigation of these mechanisms.

Finally, these studies must consider not only what effects practices regarding sleep in ECEC have, but also for whom these practices may confer benefit or risk. While there is evidence of
different sleep patterns for groups of children with psychological diagnoses (Schwichtenberg et al., 2011), currently the research evidence is not sufficiently developed to advance to studies of individual differences within the ECEC context. However, a future program of work should consider the interface of social and cultural variation, temperament, physical health and psychological diagnoses with sleep practices in childcare.

The proposed research agenda has high salience for the many families utilising ECEC. This agenda is also essential for ongoing translation into policy and practice regarding sleep, and indeed time-scheduling more broadly within these services, such that they optimise children’s development, learning and well-being. The growing body of data associating early sleep patterns with long-term health outcomes identifies sleep in early childhood settings as a focus for public health intervention.
References


Figure 1. Normative developmental transition of sleep patterns over the first 5 years of life. Each diagram denotes indicative sleep pattern over a 24hr period. (a) Percentages represent those who have reached the respective sleep pattern by the indicated age (e.g. 50% of children have reached monophasic sleep by age 3 years) and are based on those reported by Iglowstein, Jenni, Molinari and Largo (2003).
Figure 2. Percentage of children napping at different ages based on data from longitudinal studies of sleep patterns. Markers indicate data collection points. Samples derived from (a) Switzerland, N=493 children; (b) United Kingdom, N=11,500 children; (c) United States, N=172 children.
Figure 3. Child, family background and environmental factors associated with sleep patterns and sleep problems in young children. Identified factors are adapted from reviews by Iwata et al. (2011), Owens (2004) and Touchette et al. (2009).
**Figure 4.** Theoretical mechanisms and effects of mandatory nap time in early childhood education and care settings on child outcomes. a) Decreased homeostatic sleep drive following nap; b) Reduced sleep propensity may lead to increased difficulty initiating nighttime sleep; c) Lagged effect at school entry due to difficulty adjusting to sudden removal of nap time; d) Reduced physical/emotional stress due to opportunity for quiet rest and relaxation; e) Increased emotional stress as a response to extended periods without alternative activity provided; f) Disruption of nighttime sleep due to associating sleep with a stressful experience.