SLEEP CHARACTERISTICS IN THE ITALIAN PEDIATRIC POPULATION: A SYSTEMATIC REVIEW

Valeria Bacaro, Dimitri Gavriloff, Caterina Lombardo, Chiara Baglioni

Abstract

Objective: During childhood sleep duration, quality and patterns evolve and change greatly and relate strongly to healthy development. This systematic review aims to summarize the literature on sleep characteristics in the Italian pediatric population, adopting a cultural perspective.

Method: Pubmed, PsycINFO and Medline databases were systematically searched. Eligible studies had to: include Italian children and adolescents; report data for one or more sleep-related variables; be published in English or Italian.

Results: Twenty-nine studies were selected including 18551 Italian children or adolescents. Studies were categorized by age group: infancy and toddlerhood (0-3 years); preschool and school age (3-12 years); adolescence (12-18 years) and mixed age groups. Overall, studies showed that the Italian pediatric population present shorter sleep duration and longer sleep onset latency compared to international recommendations. Furthermore, data indicate high prevalence of dysfunctional sleep habits, such as late bed-time (all age groups), involvement of parents during bed-time (infancy and toddlerhood), and high variability between sleep times on week-days vs. weekends (adolescence). Nevertheless, most studies lacked comprehensive data on sleep patterns, focusing instead on isolated variables.

Conclusion: These results suggest a strong trend among Italian children and adolescents towards unhealthy sleep patterns. Comprehensive data are still lacking and large studies evaluating a broad range of sleep characteristics in Italian pediatric populations are needed. Data strongly suggest that Italian Pediatric Primary Care should place higher focus on sleep problems and implement clinical protocols directed towards improving sleep patterns in children and adolescents.

Key words: sleep habits, sleep characteristics, pediatric, systematic review, italian

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Introduction

Background

Given its centrality to optimal health and function, sleep consolidation is a key psychophysiological process during childhood development, a dynamic period that is characterized by the rapid evolution of sleep duration and architecture (Ohayon et al., 2004). During early infancy, sleep is distributed throughout the day and night, and it is characterized by short periods of sleep which are based on feeding frequency. Around 10 weeks of age, infant sleep starts to consolidate in the nocturnal period (Davis, Parker & Montgomery, 2004). This sleep consolidation process depends on a complex interplay between biological processes, and environmental, behavioral and social factors. Particularly, the most impacting factors seem to be parenting practices, expectations and routines (Mindell & Owens, 2015).

Therefore, the consolidation of the sleep-wake patterns during childhood is bidirectionally linked with multiple developmental and environmental systems. El-Sheikh & Sadeh (2015) proposed an ecological systems perspective about sleep in the early stages of life. Based on this model, sleep consolidation processes could influence and at the same time are affected by several factors such as the child development, family, social and cultural context. Parents and caregivers behaviors and cognitions influence children' sleep, and, at the same time, infant sleep represents a key factor in family adjustment and parental sleep (Tikotzky & Sadeh, 2009). The family plays a vital role in creating a healthy environment for the baby to sleep at night and wake during the day. Moreover, the social context, including peer relationship, friends, school habits and

their schedules, learning skills and socio-economic background, could play a crucial role in influencing children' sleep. In this context, one of the most studied factors is the influence of the school start time (e.g. Carissimi et al., 2016). Finally, the cultural context influences perceptions, expectations, sleep rules and possible interventions for sleep problems. One of the most investigated cultural sleep patterns is co-sleeping habit. Co-sleeping is defined as bed-sharing typically with adult caregivers. In literature, results on co-sleeping are very controversial and it was associated with both positive and negative health related outcomes. The practice of co-sleeping and the distribution of sleep over 24 hours, can affect sleep pattern and habits of families and children.

Recent studies from many countries reported that significant proportions of children and adolescents do not achieve the recommended sleep durations outlined in clinical guidance (Matricciani, Olds & Petkov, 2012). These conditions of sleep deprivation and/or poor sleep quality in childhood and adolescence are known to be linked with several negative health outcomes (Beebe, 2011), behavioral and emotional problems, which in turn impact educational progress and social development (e.g. Mindell et al., 2017; Hysing et al., 2016). Particularly, healthy sleep in terms of duration and continuity is associated with key developmental factors, including general psychological functioning (Hatzinger et al., 2014) and cognitive performance (Lam et al., 2011). Furthermore, poor sleep plays a role also in the social relationship context as peer acceptance, social skills, social engagement and emotional' understanding (Vaughn et al., 2015). Recent studies highlighted the important role of both nocturnal and diurnal sleep in the early stage of life in cognitive and affective processes central to self-regulation (Hysing et al., 2016; Bacaro et al.,2020).

During the pediatric age, the main developmental sleep issues are bedtime problems, excessive daytime sleepiness, awakenings during the night and the regularity and duration of sleep. Particularly, in the two most widely used diagnostic schedules, the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5; American Psychiatric Association, 2013) and the International Classification of Sleep Disorders, 3rd Edition (ICSD-3; American Academy of Sleep Medicine), there is no a diagnostic distinction between adult and pediatric insomnia. Nevertheless, pediatric insomnia clinical features include some specific sleep issues:

- Unhelpful sleep onset associations (Owens, 2008), typically requiring parental involvement in the facilitation of sleep onset (e.g. presence, rocking, patting) that could be present both when the child is put in the bed and during night awakenings.
- Problems with parental limit setting (Owens, 2008);
- Absence of consistent bedtime routines (Mindell & Owens, 2015; Mindell & Williamson, 2018).
- Poor sleep hygiene, such as the child's use of caffeine, inappropriate sleep schedules (e.g. staying up or sleeping late) or use of inappropriately timed use of technology (e.g. TV, phone use or playing video games).
- Bedroom environment: Environmental light, noise, and temperature of the room can all influence sleep continuity.

Prevalence rates for pediatric sleep disorders range from 1-3% for obstructive sleep apnea to as high as 20-30% for insomnia disorder (Owens, 2008). Despite their high prevalence and their negative impact, pediatric sleep disorders are generally poorly diagnosed and treated in many clinical settings (Meltzer et al., 2014). Importantly, theoretical models on developmental sleep underlie the importance to consider cultural influences on sleep habits and patterns (Sadeh et al., 2010). Previous work stressed the need to document pediatric sleep patterns by taking into consideration culture-specific issues (Jenni & O'Connor, 2005). This is because culture may play an important role in defining parental behaviors and beliefs, as well as the attitudes of the children and adolescents themselves. Thus, adopting a cultural perspective may help cross-cultural comparisons and development of specific guidelines pertinent to local primary care.

The present systematic review aimed to describe sleep characteristics in the Italian pediatric population in order to provide useful data for cross-sectional comparisons and to delineate guidelines for Italian pediatric clinical practice. Three developmental age groups were considered:

a. Infants and toddlers (0-3 years);
b. Preschoolers and school age children (3-12 years);
c. Adolescents (13-18 years).

Sleep characteristics and problems across the developmental range

- *Infants and toddlers*: Families of infants and toddlers often reported excessive sleep onset latencies, difficulties with independent child sleep initiation and frequent night awakenings that necessitate parental involvement in resettling the child (e.g. Mindell et al., 2006;). In fact, epidemiological estimates suggest that as many as 30% of young children may experience these problems on a regular basis (Mindell et al., 2006). National Sleep Foundation (Ohayon et al., 2017; Hirshkowitz et al., 2015) recommendations for this age group include: sleep onset latency (SOL) < 30 minutes, wake after sleep onset (WASO) < 20 minutes and total sleep time (TST) ranging from 12 to 17 hours for infants and from 11 to 14 hours for toddlers. During these first years of life, parental behaviors at bedtime strongly influence developing sleep patterns (Allen et al., 2016). Factors associated with consolidated sleep in young children include appropriately early bedtimes (e.g. Kohyama et al., 2000) and the child's ability to fall asleep on his/her own without parental presence (Mindell et al., 2006). Furthermore, a key factor for the establishment of healthy sleep habits is the institution of a consistent and regular bedtime routine (Mindell et al., 2015). Mindell and colleagues (2015) found that this relationship was significant across all age groups (infants, toddlers, and preschoolers) and different cultures. To institute a regular and consistent bedtime routine for infants predicted better sleep outcomes in later ages, but findings suggested that the most important factor was to perform a current regular pre-bed routine. Bedtime routines could play a potential role in decreasing bedtime arousal, ameliorating children ability to fall asleep and to self-sooth (Mindell et al., 2015). Furthermore, authors underlined a potential possible mechanism for which regular bedtime routines are a marker of overall parent behavior management, potentially indicating more competences to engage in other positive sleep practices, such as early bedtimes and parental limit-setting.
- *Preschoolers and school-aged children*: During this

age a large proportion of parents tends to be present when the child falls asleep, and many families practice co-sleeping, especially in preschool years. Furthermore, in school-age children, participation to extra-school activities and school duties may be associated with delayed bedtime (Zhang et al., 2010) and, in recent years, attention has been dedicated to use of electronic devices at this age (Cain & Gradisar, 2010). National Sleep Foundation (Ohayon et al., 2017; Hirshkowitz et al., 2015) recommendations include: SOL < 30 minutes and WASO < 20 minutes, TST between 10 and 13 hours for preschoolers and between 9 and 11 hours for school-aged children. Important factors associated with consolidated nocturnal sleep during this age include changes in pre-sleep behavior (e.g. pre-bed routines), gradual delaying of bed-time and reduction in co-sleeping (Mindell et al., 2013; Galland et al., 2012). Difficulties initiating or maintaining sleep in preschool children are very common, and are often associated with bedtime resistance (30-to-50%). Similarly, it has been estimated that up to 30% of school-age children suffer of insomnia. Parents of preschoolers and school-aged children should establish a consistent and regular daytime routine in order to help the regularization of the child' sleep-wake schedule (Mindell & Owens 2015).

- *Adolescents*: For this age group, the National Sleep Foundation (Ohayon et al., 2017; Hirshkowitz et al., 2015) indicated as appropriate SOL < 30 minutes, WASO < 20 minutes and TST ranging between 8 and 10 hours. Interestingly, there is growing evidence that adolescents nowadays are sleeping for significantly less time compared to previous decades (Keyes et al., 2015). This could be a consequence of the incompatibility of the developmentally normative delays to circadian sleep-wake phase common at this age and early school start times. Other factors highlighted as further impacting behavioral sleep problems at this age include increased use of electronic devices that is associated with later bedtimes, shorter sleep duration, longer sleep onset latency, insomnia or sleep difficulties, lowered sleep quality or sleep efficiency, and reduced daytime functioning or tiredness (Pallesen, 2008; Owens, 2014). Symptoms of insomnia are frequent also during adolescence and are often associated with daytime tiredness. Approximately 4-10% of all adolescents show symptoms of insomnia (Gau & Soong, 2003; Ohayon et al. 2000; Johnson et al. 2006), ranging even to a diagnosis of insomnia (Johnson et al., 2006).

Italian culture and sleep

Several studies focusing on the Italian population have concluded that there is poor societal knowledge of sleep and its importance to development in children (Wolf et al., 1996; Bruni et al., 2004). Indeed, data suggest that dysfunctional parental involvement in the nocturnal sleep of Italian children is commonplace and may represent a risk factor in the development of pediatric insomnia (Wolf et al., 1996). Most parents and pediatricians in Italy are unlikely to discourage excessive active parental presence during the night for young children, and usually do not promote typical sleep hygiene from early childhood to late adolescence (Giannotti et al., 2005). Furthermore, previous studies pointed out that in Italy, parents often include their children in their adults' evening social activities and letting them fall asleep before going to bed, resulting in unstructured bedtime routines and delayed bedtime (Hense et al., 2011). Nevertheless, no systematic review has yet been published that describes these sleep characteristics in Italian children and adolescents such that it may inform Italian pediatric primary care.

The present study

This systematic review aims to provide a comprehensive overview of the extant literature on sleep characteristics (sleep variables, sleep habits) of Italian infants, toddlers, preschoolers, school-aged children and adolescents and to consequently provide data for cross-cultural comparisons, direct research and local clinical recommendations.

Method

The study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations for reporting systematic reviews and meta-analyses (Liberati et al., 2009). The PRISMA checklist is available in Document S1.

Inclusion criteria

Study eligibility was assessed using the Population, Intervention, Comparison, Outcomes and Study design (PICOS) approach (O'Connor et al., 2008). In order to be included, studies had to fulfill all following inclusion criteria: a) Population: Italian infants, children and adolescents ≤ 18 years old; b) Intervention/Exposure: any measurement of sleep parameters, sleep duration and sleep habits; c) Comparator group: not applicable; d) Outcomes: primary outcomes referred to sleep parameters and specifically TST; SOL; WASO; bedtime; number of awakenings (NA); number of naps. Secondary outcomes referred to sleep habits, and specifically parental involvement during sleep onset and co-sleeping for young children (infants, toddlers, preschoolers and school-aged children), bedtime routines (all age groups), variability between week days and weekends (preschoolers, school-aged children and adolescents), use of electronic devices (all age groups), circadian preference (all age groups); d) Study design: cross-sectional, longitudinal, case control; e) Language: English and Italian. No starting publication period restriction was made. Studies related to Covid-19 pandemic situation were excluded from this systematic review. The search was conducted up to April 2021.

Search strategy

Several strategies were used for identifying the final study sample.

First, we conducted computer-based searches using the electronic databases of Pubmed, PsycINFO and Scopus according to the following keywords: (((Ital*[Affiliation]) AND (sleep[Title/Abstract]) AND (child*[Title/Abstract] OR infan*[Title/Abstract] OR toddl*[Title/Abstract] OR preschool*[Title/Abstract] OR school*[Title/Abstract] OR adolesc*[Title/Abstract] OR p*ediatr*[Title/Abstract] OR teen*[Title/Abstract] OR young*[Title/Abstract] OR youth*[Title/Abstract]))).

The literature search, screening of studies,

examination of full texts and extraction of data was conducted by the first author (V.B.), with the help of a graduate student. Whenever there was disagreement the inclusion or exclusion of an article was discussed by all authors. Full-texts were screened for identification of further studies that may have met inclusion criteria. Published conference proceedings from sleep-related journals from 2014 to 2020 were also screened by the first author. Both searches and screening were run on Citavi 6 (a reference management software; https://www.citavi.com).

Data extraction

The first author extracted data to confirm accuracy, any doubt was managed through author consensus between first and last authors. For each selected study, the following socio-demographic and methodological variables were extracted: a) year of publication; b) sample size; c) health status of participants; d) age range; e) average age; f) percentage of females; g) region of Italy; i) parental age; l) parental educational level; m) study design; n) outcome assessed; o) instruments.

Risk of bias assessment

The risk of bias assessment was performed by the first author with the help of a graduate student and any doubt was managed through author consensus between first and last authors. For assessment of cross-sectional studies the Appraisal tool for Cross-Sectional Studies (AXIS) was used (Downes et al., 2016). This tool is composed of 20 items which investigate the methodological quality of selected studies by providing "yes" or "no" as possible answers. Scoring was made assigning 1 for yes and 0 for no.

There were four longitudinal studies, one experimental study, one intervention study, and one case-control study. As these were not cross-sectional in design, no risk of bias assessment was able to be conducted and only qualitative descriptions have been provided.

Results

Study Selection

Figure 1 illustrates the detailed flow chart of the selection process. Database searching yielded 4141 abstracts (PubMed: n = 1475; PsycINFO: n = 2599; Scopus: n= 67). Of these, 731 were duplicates. After removing duplicates, a total of 3410 abstracts remained. Titles and abstracts were examined for relevance and 3327 were excluded. Reference lists of the retrieved original articles were screened but no more records were found. Sixty-six records were scrutinized and 54 studies were excluded. A total of 29 studies met the inclusion criteria and were therefore reviewed.

Study characteristics and risk of bias assessment

A summary of the included studies is presented in **table 1**. Of the included studies, 21 were cross-sectional studies; three were longitudinal studies (Bruni et al., 2005; 2014; Sette et al., 2017); two were an intervention study (Cortesi et al., 2012; Zaccari et al., 2021), two were case-control study (Bruni et al., 1997, 2020) and one was an experimental study (Giganti et al., 2014). The sample size ranged from a minimum of 10 to a maximum of 3463 participants for a total of 18551 children and adolescents. Participants were subdivided into the following age group categories: infants and toddlers (respectively 0-1 and 1-3 years, Bruni et al., 2014; Sette et al., 2017; Chindamo et al., 2019; Fazzi et al., 2006; Bacaro et al., 2019; 2020; Bisogni et al., 2015); preschoolers and school-aged children (respectively 3-5 years and 5-12 years, Bruni et al., 2002; 2005; 2009; 2020; Giganti et al., 2014; Cortesi et al., 2003; 2008; 2012; Ficca et al., 2011; Melegari et al., 2020; Zaccari et al., 2021) and adolescents (12-18 years; Bruni et al., 2015; Giannotti et al., 2002; Ferranti et al., 2016; Manni et al., 1997; Russo et al., 2017). One study (Brambilla et al., 2017) evaluated children and adolescents from 0 to 18 years, but reported data separately for age groups. This study was therefore included in all three age group categories considering only the associated values for each category. The remaining studies recruited mixed age samples and have been described separately (Bruni et al., 1997; 2008; Brunetti et al., 2001; D'Aniello et al., 2015; Russo et al., 2007).

The majority of studies utilized self-reported sleep measures including questionnaires and diaries. Only seven studies used physiological measurement of sleep with actigraphy (Cortesi et al., 2012; Giganti et al., 2014; Melegari et al., 2020; Zaccari et al., 2021) or polysomnography (PSG; Bruni et al., 2002; 2005; 2009).

Quality assessment scoring of the studies ranged from a minimum of 13 to a maximum of 18 with a maximum score of 20. All evaluated studies reported information on the target population, the sample frame and the selection process. All studies used validated instruments and provided sufficient information on methodology employed. All assessed studies presented full results for their reported analyses and provided a discussion and conclusion that were justified by results. Not all studies discussed limitations. Detailed risk of bias assessment evaluations are presented as supplementary material Document S2. The total score of each study is also presented in **table 1**.

Qualitative evaluation of level of evidence of non-cross-sectional studies

Information on assessed variables, sample size and reported data were evaluated. Only one study included physiological sleep measures (Bruni et al., 2005). Furthermore, three studies did not report the mean age of participants (Bruni et al., 2014; Sette et al., 2017; Zaccari et al., 2021). Finally, the experimental study (Giganti et al., 2014) had a relatively small sample size composed of only 23 participants compared to longitudinal studies (Bruni et al., 2014, 2015; Sette et al., 2017) with much larger sample sizes (>200 participants).

Infancy and toddlerhood

The main results for studies that evaluated sleep parameters and characteristics in Italian infants and toddlers (0-3 years) are presented in **table 2**.

Sleep parameters

- *TST*: On average, based on data from questionnaires and structured interview directed to parents, Italian infants and toddlers (N= 2409) were reported to sleep in total 9.6 hours (averaged from Bacaro et al., 2019; Brambilla et al., 2017; Bruni et al., 2014; Chindamo et al., 2019).
- *WASO and NA*: In three studies (Bruni et al., 2014; Sette

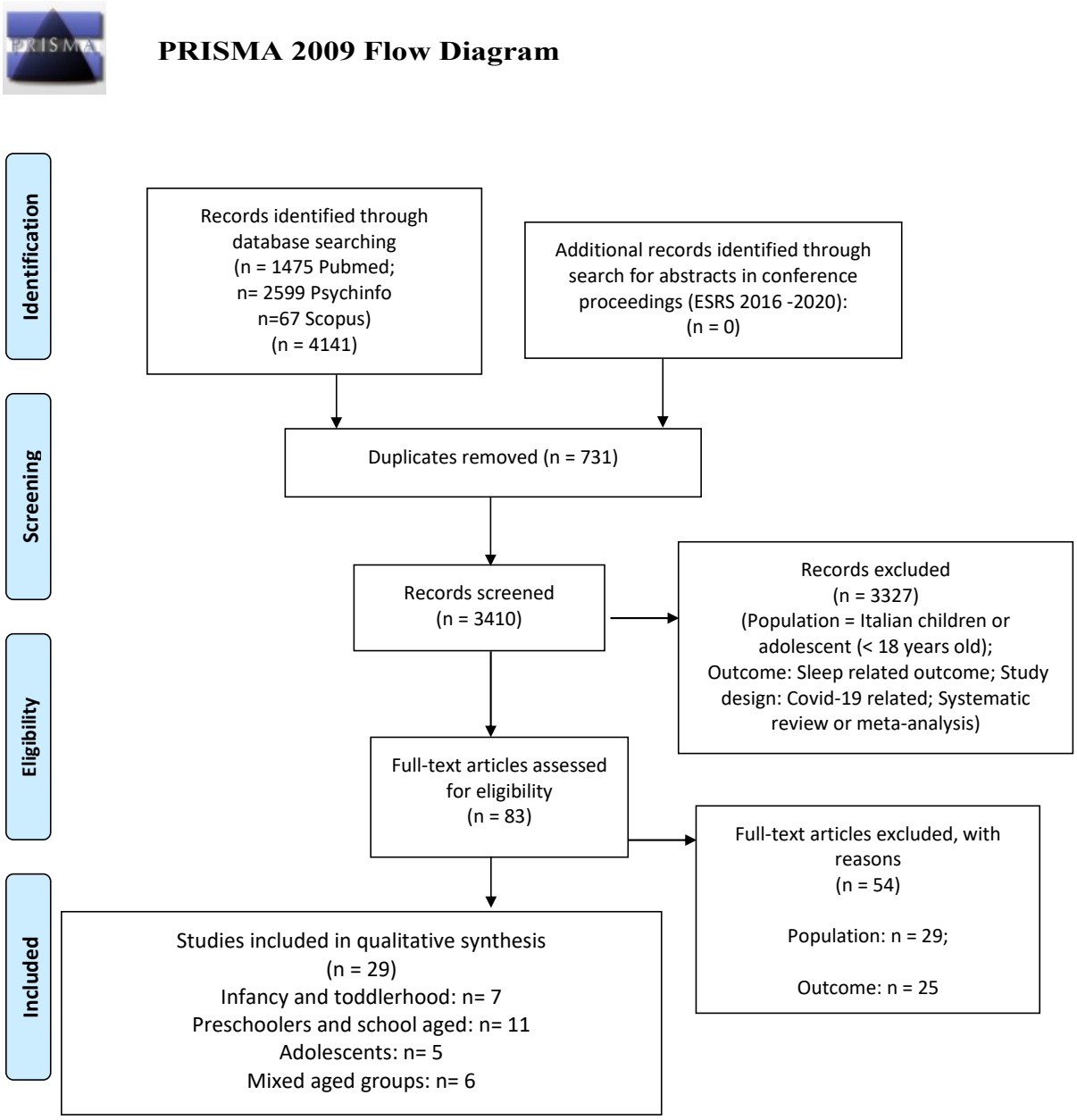
Table 1. *Study characteristics*

Study	Sample size (n =)	Age range and Age category	Mean age	Gender (% female)	Region	Study design	Primary outcomes	Secondary outcomes	Quality assessment
Bacaro et al., 2019	65	02-36 months (Infancy and toddlerhood)	19.6 ± 9.60 months	53.80%	All territory	Cross-sectional	Sleep parameters	Bedtime; parents involvement	17
Bacaro et al., 2020	92	06-36 months (Infancy and toddlerhood)	22.67 months	43%	All territory	Cross-sectional	Sleep parameters	Bedtime; parents involvement	17
Bisogni et al., 2015	201	0 - 2 years (Infancy and toddlerhood)	11.2 ± 10.3 months	42.80%	Not reported	Cross-sectional	Sleep parameters	Bedtime	15
Brambilla et al., 2017	2030	1-14 years (Infancy, toddlerhood, preschool, school-age and adolescence)	5.25 years	49.40%	47% North of Italy; 17% Centre of Italy; 36% South of Italy	Cross-sectional	Sleep parameters	Use of electronics devices	16
Brunetti et al. 2001	1207	03-11 years (Toddlerhood, preschool, school-age and adolescence)	7.3 years	51%	South of Italy	Cross-sectional	Sleep parameters	n/a	18
Bruni et al. 1997	283	5-14 years (School age and adolescence)	10.11 years	49.10%	Centre of Italy	Cross-sectional / Case-control	Sleep parameters	Co-sleeping	15
Bruni et al. 2002	10	6-10 years (School age)	8.3 years	40.00%	Not reported	Cross-sectional	Sleep parameters	n/a	15
Bruni et al., 2005	10	3-6 years (Preschool)	4.6 years	60.00%	Not reported	Cross-sectional	Sleep parameters	n/a	Not applicable
Bruni et al. 2008	1073	8-15 years (School age and adolescence)	10.5 years	49.10%	Centre of Italy	Cross-sectional	Sleep parameters	Difference between weekdays and weekend	16
Bruni et al., 2009	32	2.9-10.3 years (Preschool and school age)	6.4 years	43.70%	Not reported	Cross-sectional	Sleep parameters	n/a	15
Bruni et al., 2014	704	1-12 months (Infancy)	3 months	49.30%	All territory	Longitudinal	Sleep parameters	Bedtime; parents involvement	Not applicable
Bruni et al., 2015	850	11-16 years (Adolescence)	13.5 years	57.10%	Centre of Italy	Longitudinal	Sleep parameters	Bedtime; use of electronic devices	16
Bruni et al., 2020	167	24-71 months (Preschoolers)	44.3 months	51%	Centre of Italy	Case control	Sleep parameters	Bedtime; sleep arrangement	Not applicable

Table 1. *Continued*

Chindamo et al., 2019	1117	12-23 months (Toddlerhood)	25.3 months	48.70%	All territory	Cross-sectional	Sleep parameters	Parents involvement	15
Cortesi et al., 2004	901	6.1-11.9 years (School age)	8.4 years	53.30%	Centre of Italy	Cross-sectional	n/a	Co-sleeping	15
Cortesi et al., 2008	376	5-9 years (School age)	5.8 years	Co-sleepers: 46% solitary sleepers: 48%; control: 52%	Centre of Italy	Cross-sectional	Sleep parameters	Co-sleeping	16
Cortesi et al., 2012	160	4-10 years (Preschool and school age)	6.6 years	Not reported	Centre of Italy	Intervention	Sleep parameters	Bedtime	Not applicable
D'Aniello et al., 2006	54	5-16 years (School age and adolescence)	9.8 years	Not reported	Not reported	Case control	Sleep parameters	n/a	Not applicable
Fazzi et al., 2006	50	10-39 months (Toddlerhood)	22.94 months	46%	North of Italy	Cross-sectional	Sleep parameters	Parents involvement	16
Ferranti et al., 2016	1586	11-14 years (Adolescence)	12 years	45%	South of Italy	Cross-sectional	Sleep parameters	Bedtime	16
Ficca et al., 2011	465	6-12 years (School age)	Not reported	49.60%	South of Italy	Cross-sectional	Sleep parameters	Difference between weekdays and weekend	16
Giannotti et al., 2002	742	14.1-18.6 years (Adolescence)	16.8 years	42%	All territory	Cross-sectional	Sleep parameters	Difference between weekdays and weekend	15
Giganti et al., 2014	23	38-70 months (Preschool)	52.6 months	43%	Not reported	Experimental	Sleep parameters	n/a	Not applicable
Manni et al., 1997	1226	n.a.(Adolescence)	17 years	60%	North of Italy	Cross-sectional	Sleep parameters	Bedtime	15
Melegari et al., 2020	21	48-69 months (Preschool)	5.1 years	16%	Centre of Italy	Cross-sectional	Sleep parameters	n/a	16
Russo et al., 2007	1073	8-14 years (School age and adolescence)	10.6 years	49.20%	Centre of Italy	Cross-sectional	Sleep parameters	Co-sleeping; difference between weekdays and weekend	16
Russo et al., 2017	3463	Not reported (Adolescence)	13.8 years	50.40%	Not reported	Cross-sectional	Circadian preference	Difference between weekdays and weekend	13
Sette et al., 2017	704	3-12 months (Infancy)	3 months	49.30%	Not reported	Longitudinal	Sleep parameters	n/a	Not applicable
Zaccari et al., 2021	32	7-11 years (School age)	Not reported	28%	Centre of Italy	Intervention	Sleep parameters	n/a	Not applicable

Figure 1. *"Search flow diagram"*



et al., 2017; Brambilla et al., 2017, total N=1931), using structured interview directed to parents, data evidenced that, on average, the 8.4% of children had more than 2 awakenings per night. In another study, Fazzi et al. (2006) (N=50) found that toddlers had on average 1.8 nighttime awakenings per night based on parental questionnaires. Furthermore, on average, based on data from questionnaires directed to parents, Italian infants and toddlers (N= 157, averaged from Bacaro et al., 2019; 2020) were reported to have a WASO of 27.4 minutes.

- *SOL*: Averaged SOL, based on parental questionnaires, (N= 1324) was 28.1 minutes (averaged from Bacaro et al., 2019; 2020; Chindamo et al., 2019; Fazzi et al., 2006;).
- *Bedtime*: Bacaro et al. (2019) found that all children in their sample (N=65) had bedtime after 8:00 p.m., with 49% of them going to bed after 10:00 p.m. Furthermore, Bisogni et al., 2015 found that 40% of their sample (N=201) were reported to go to bed between 10:00 and 11:00 p.m. Finally, Bruni et al., 2014 (N=704) found an average bedtime at 10:00 p.m.
- *Number and duration of diurnal naps:* no information could be collected.

Sleep habits and problems

- *Parental involvement and co-sleeping:* Chindamo et al. (2019, N=1117) found that 64.6% children slept with their parents and 8.4% fell asleep in front of the television. Bruni et al. (2014, N=704) and Fazzi et al., (2006, N=50) reported that respectively 20% and 54% of infants were able to fall asleep alone. Bacaro et al. (2019, N=65) and (2020, N=92) found that only approximately 60% of parents reported allowing children to fall asleep in their own bed.
- *Bedtime routines, circadian preference and use of electronic devices during bedtime:* no information could be collected.

Table 2. *Infant and toddlers sleep characteristics*

	Total Sleep Time	*Wake after sleep onset*	*Sleep onset latency (Mean)*	*Fall asleep alone%*	*Bedtime*	*Measures*
Infants						
Bruni et al., 2014	9.4 h (mean)	8.8% > 2 awakenings per night	Not reported	20%	22:00	Parent-reported
Sette et al., 2017	19.5% ≤10 h	9% > 3 awakenings per night	Not reported	Not reported	Not reported	Parent-reported
Toddlers						
Chindamo et al., 2019	9.9 h (mean)	Not reported	28.9 m	35.40%	Not reported	Parent-reported
Fazzi et al., 2006	Not reported	1.8 (mean) awakenings per night	14.5 m	54%	Not reported	Parent-reported
Infants and toddlers						
Bacaro et al., 2019	8.6 h (mean)	23.2 m (mean)	34.7 m	60%	49% after 22:00	Parent-reported
Bacaro et al., 2020	9.05 h (mean)	31.6 m (mean)	33.9 m (mean)	63%	Not reported	Parent-reported
Bisogni et al., 2015	36.5% between 7-9 h	44.2%: 2-4 awakenings per night	Not reported	Not reported	40% 22:00-23:00	Parent-reported
Brambilla et al., 2017	Infant: 11.5 h; Toddlers:10.5h (mean)	7.5% > 3 awakenings per night	Not reported	Not reported	Not reported	Parent-reported

For Bruni et al., 2014 only baseline data were extracted (3 months);for Bisogni et al., 2014 only data for children who slept at home were extracted

Preschoolers and schooled aged children

Specific main results for preschoolers and school-aged children (3-12 years) are presented in **table 3**.

Sleep parameters

- *TST:* Italian preschoolers and school-aged children were reported from their parents in questionnaire and structured interview to have an average TST of 9.4 hours (averaged from Ficca et al., 2011; Brambilla et al., 2017, Bruni et al., 2020). Furthermore, from polysomnographic and actigraphic studies emerged that preschoolers and school-aged children' TST was of 8.9 hours (averaged from Bruni et al., 2002; 2005; 2009; Melegari et al., 2020; Zaccari et al., 2021).
- *WASO and NA*: From polysomnographic and actigraphic studies emerged that preschoolers and school-aged children' WASO was of 35.4 minutes (averaged from Bruni et al., 2002; 2009; Melegari et al., 2020; Zaccari et al., 2021). Brambilla et al., 2017 found that parents of children reported that 8.7% of them had > 3 awakenings per night.
- *SOL*: The averaged parent reported SOL for preschoolers and school aged children was 23.4 minutes (averaged from Ficca et al., 2011; Giganti et al., 2014). SOL averaged from polysomnographic and actigraphic studies was 14.4 minutes (averaged from Bruni et al., 2002; 2005; 2009; Melegati et al., 2020; Zaccari et al., 2021).
- *Bedtime and number of naps:* no information could be collected.

Finally, extracting only pre-treatment data from a randomized controlled trial by Cortesi et al. (2012), which included a sample of 134 children from Rome with autism spectrum disorder and insomnia, it emerged that there was an average TST of 414.03 minutes, SOL of 85.84 minutes, and WASO of 69.50 minutes. This suggests that sleep difficulties in children who present with other clinical disorders may be more common and severe, compared to the general population.

Sleep habits and problems

- *Co-sleeping:* The study by Cortesi et al. (2004) of 901 children found a 5% prevalence of co-sleeping. Furthermore, Cortesi et al. (2008, N=376) reported that co-sleepers showed significantly worse sleep parameters than solitary sleepers.
- *Parental involvement at bedtime, bedtime routines, circadian preference, variability in sleep times between week-days and weekends and use of electronic devices at bedtime:* no information could be collected.

Adolescents

The main results for studies that evaluated sleep parameters and characteristics of Italian adolescents (12-18 years) are presented in **table 4**.

Sleep parameters

- *TST*: On average, Italian adolescents (N=6939) reported in questionnaires to have TST of 8.6 hours (averaged from Brambilla et al., 2017; Bruni et al., 2015; Ferranti et al., 2016; Giannotti et al., 2015; Russo et al., 2017).
- SOL: One study from Bruni et al., 2015 reported an average SOL ranging between 6 and 15 minutes on a sample of 850 adolescents.
- *Bedtime*: Bruni et al. (2015, N=850) reported an average bedtime of 10:47 p.m. Manni et al.1997 (N=1226) found that the 54.2% went to sleep between 10:00 and 11:00 p.m. Two studies (Giannotti

Table 3. *Preschoolers and school aged children sleep characteristics*

	Total sleep time (Mean)	*Wake after sleep onset (Mean)*	*Sleep onset latency (Mean)*	*Co-sleeping %*	*Measures*
Preschoolers					
Bruni et al., 2005	548 m	10.1 m	14.1 m	Not reported	Polysomnography
Bruni et al., 2020	588 m	2.7 m	Not reported	19%	Parent-reported
Giganti et al., 2014	Not reported	6 m	25 m	Not reported	Parent-reported
Melegari et al., 2020	593.1 m	61.53 m	10.29 m	Not reported	Actigraphy
School aged children					
Bruni et al., 2002	499 m	11.9 m	22.2 m	Not reported	Polysomnography
Cortesi et al., 2004	Not reported	Not reported	Not reported	5% (2.7% = girls; 2.3% = boys)	Parent-reported
Cortesi et al., 2008	Cosleepers: 450 m; Solitary sleepers: 480 m	Cosleepers:13.9 m; Solitary sleepers: 6.9 m	Cosleepers: 45 m; Solitary sleepers: 40.2 m	29.7%	Parent-reported
Ficca et al., 2011	Weekdays: 9.3 h; Weekends: 10.3 h	Not reported	Weekdays: 21.4 m; Weekends: 22.5 m	Not reported	Parent-reported
Zaccari et al., 2021	498.4 m	59 m	5.53 m	Not reported	Actigraphy
Preschoolers and school aged children					
Bruni et al., 2009	Preschoolers: 559.3 m; School aged: 547.1 m	Not reported	Preschoolers: 22.4 m; School aged: 36.3 m	Not reported	Polysomnography
Cortesi et al., 2012	414 m	69.5	85.8 m	Not reported	Actigraphy
Brambilla et al., 2017	Preschoolers: 9.7 h; School aged: 9.5h;	8.7% > 3 awakenings per night	Not reported	Not reported	Parent-reported

Legend: CSHQ: Children Sleep Habits Questionnaire; SDSC: Sleep Disturbance Scale for Children; For Melegari et al., 2020 only data for healthy development children were extracted; For Zaccari et al., 2021 only baseline data were extracted

et al., 2002; Russo et al., 2017, N=4205) considered circadian preference and found that adolescents categorized as morning types had bedtime ranging between 10:15-11:40 p.m. and adolescents categorized as evening types between 11:05 p.m. and 1:15 a.m.

Sleep habits and problems

- *Differences between weekends and weekdays:* Three studies (Ferranti et al., 2016; Giannotti et al., 2002; Russo et al., 2017) observed a delayed bedtime of on average 1 hours on weekends compared to weekdays (N = 5791).
- *Use of electronic devices:* Brambilla et al. (2017) found that 79.5% of 298 adolescents used electronic devices at bedtime and Bruni et al. (2015) reported that, on average, adolescents (N=850) turned off their devices at 11:58 p.m.
- *Circadian preference:* Giannotti et al. (2002) found that 11.1% of 742 adolescents were categorized as evening types, with 15% categorized as morning types. Furthermore, Russo et al. (2017) categorized 10% of 3463 adolescents as evening types and 8.6% as morning types.

Mixed age groups

Four studies from our systematic review had a sample composed of both school-aged children and adolescents. D'aniello et al. (2015) report an average TST of 9.10 hours (N=54). Bruni et al. (1997) found that, excluding children with migraine, 29.7% of 283 parents reported that their children were reluctant to go to bed at bedtime and 6.8% experienced more than 2 awakenings during the night. In a second study, Bruni et al. (2008) found a TST of, on average, 572 minutes on school nights and of 618 minutes on the weekends in 1073 children. Finally, Russo et al. (2007) found that the majority of the participants of their study (59.4% of 1073) reported SOL < 15 minutes, with 20.6% of them reporting a SOL of between 16 and 30 minutes, and a further 20% reporting a SOL of > 30 minutes. Moreover, results showed an average TST of 8.59 hours on school nights and 10.08 hours on weekends.

Discussion

This systematic review synthesized evidences from 29 articles about sleep characteristics in the Italian pediatric population. A total of 18551 participants from across Italy were represented in this review.

This data shows that infants and toddlers in Italy sleep on average for between 499 and 600 minutes (8.3-10 hours), which is much lower than National Sleep Foundation recommendations (Hirshkowitz et al., 2015). Furthermore, around 50% of young children were reported to go to sleep after 10:00 p.m., including a large proportion of infants. Active parental involvement at bedtime was also very commonly observed. Previous findings showed that late bedtime and parental involvement at children's sleep onset are strongly associated with negative reported sleep patterns (longer SOL and shorter TST) (Mindell et al., 2009). Furthermore, preschoolers and school-aged children presented SOL ranging from 14 to 40 minutes and TST from 414 to 600 minutes (6.9 – 10 hours),

Table 4. *Adolescents sleep characteristics*

	Total sleep time (Mean)	*Sleep onset latency (Mean)*	*Bedtime*	*Use of electronic devices*	*Measures*
Adolescents					
Brambilla et al., 2017	9 h	Not reported	Not reported	79.5% at bedtime	Self-reported
Bruni et al., 2015	7.4h	6-15 min	22:47	Average turning off time 22:58	Self-reported
Ferranti et al., 2016*	Weekdays: 8.3 h; Weekend: 10.0 h	Not reported	Weekdays: 64% 22:01-23:00; Weekend: 33% 23:01-00:00	Not reported	Self-reported
Giannotti et al., 2002	Weekdays: 485 m; Weekend: 555 m	Not reported	Weekdays - Evening type: 23:05, Morning type: 22:30; Weekend- Evening type: 01:15, Morning type: 23:40	Not reported	Self-reported
Manni et al., 1997	45%: 7-8 h	Not reported	54.2%: 22:00-23:00	Not reported	Self-reported
Russo et al., 2017	Weekdays: 8.2 h; Weekend: 9.7 h	Not reported	Morning type: weekdays: 22:12 p.m., weekend: 23:41; Evening type: weekdays: 23:21 p.m., weekend: 01:14	Not reported	Self-reported

Legend: * data from normal weight population; Adolescent Sleep Hygiene Scale (ASHS); M: males; F: females

Table 5. *Mixed age sample sleep characteristics*

	Total sleep time (Mean)	*Wake after sleep onset (Mean)*	*Sleep onset latency (Mean)*	*Bedtime*	*Measures*
Mixed age sample					
Brunetti et al., 2001	635.5 m	Not reported	Not reported	Not reported	Self-reported
D'aniello et al., 2015	9.1 h	Not reported	Not reported	Not reported	Self-reported
Bruni et al., 1997	499 min	11.9 min	22.2 min	Not reported	Self-reported
Bruni et al., 2008	Weekdays: 572 min; Weekend: 618 min	Not reported	Not reported	Weekdays: 22:20:00; Weekend: 23:30	Self-reported
Russo et al., 2007	Weekdays: 8.59 h; weekends: 10.08 h	Cosleepers:13.9 min; Solitary sleepers: 6.9 min	20% reported > 30 minutes	Not reported	Self-reported

Legend: CSHQ: Children Sleep Habits Questionnaire; SDSC: Sleep Disturbance Scale for Children

which is also significantly less than recommended in international guidelines. Findings suggest that co-sleeping (parents and children sleeping together in the same bed) is very common in Italy. Active parental presence during bedtime and co-sleeping have been associated with increased behavioral problems linked to sleep (Mindell & Owens, 2015). At the same time, previous studies suggested a predictive role of co-sleeping during early childhood on future confidence and self-esteem (e.g. Keller & Goldberg, 2004; Crawford, 1994). More recently, a study suggested that co-sleeping during infancy could play a potential role in promoting more positive and well-regulated behavior during dyadic interaction (Lerner et al., 2020). Particularly, Lerner and colleagues (2020) evaluated the longitudinal association between mother-infant co-sleep at 3 months and infant affect and behavior during a dyadic challenge task at 6 months in 63 mother-infant dyads, examining also nighttime mother-infant contact at 3 months as a possible mechanism that may mediate linkages between co-sleeping and infant outcomes. They found that co-sleepers at 3 months displayed significantly more self-regulatory behaviors during the still-face episode of the Still-Face Paradigm (SFP) at 6 months, compared to children who were not co-sleepers. This relationship was not mediated by nighttime mother-infant contact. The results suggest that the age during which co-sleeping is performed seems to play an important role, thus, during early childhood co-sleeping could be adaptative and promote a future healthy sleep, but when the child grow-up it seems to be not necessary and could be associated with more negative consequences. As suggested in previous literature, it appears of utmost importance to considering specific families practice and habits because parental and infant sleep are bidirectionally and dynamically linked (Sadeh et al., 2010). Specifically, as suggested by the transactional model, this association include different level of parenting such as parental behaviors, cognitions and emotions, parent–child relationships and attachment. At the same time, a large amount of studies highlighted that infant sleep can influence parental mood and well-being, as well as modify parental behaviors and reactions (Sadeh et al.,

2010). For this reason, the practice to co-sleep could be very influenced by the familiar and socio-cultural context, and it is important to investigate the decision of families to co-sleep, differentiating between "lifestyle" or "cultural" co-sleeping. Indeed, the practice of co-sleeping could be very influenced by the socio-cultural context, but it is important to understand this practice is implemented in response to the child's sleep difficulties (Mindell & Owens, 2015). Understanding that parental lifestyles, behaviors and cognitions change much more quickly than infant biology can lead to better ways of educating parents on sleep choices for themselves and their infant (Barry et al., 2020). Educating parents about their infant sleep patterns and needs will help them to balance parental choice and practices optimizing infant sleep needs (Barry et al., 2020).

For adolescents, results showed an average TST of 8 hours that is close to the minimum end of the range in international recommendations. Furthermore, studies observed a high variability in sleep patterns between weekdays and weekends in both preschoolers, school-age children and adolescents. Average bedtimes from our sample are alarmingly late in all age groups (10:00 p.m. for infants and toddlers and 11:30 p.m. for adolescents), considering that schools in Italy start at approximately 8:00 a.m. each morning. This is therefore suggestive of large groups of Italian children getting insufficient nightly sleep during the week. In previous studies, later weeknight bedtime, shorter weeknight sleep duration, greater weekend bedtime delay, and both short and long periods of weekend oversleep were associated with increased odds of mood, anxiety, substance use, and behavioral disorders, as well as suicidality, tobacco smoking, and poor perceived mental and physical health (Zhang et al., 2017).

Total sleep duration, sleep onset latency and bedtimes for all three age categories from included studies are compared with recommendations from the National Sleep Foundation and presented in **figure 2**.

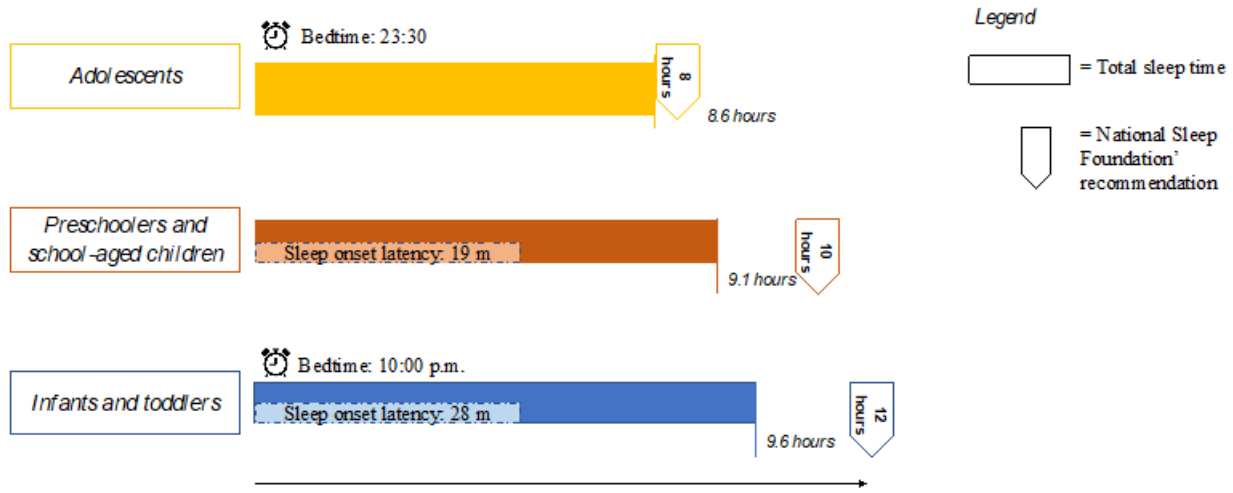
Limitations and guidelines for future research

This systematic review highlights some important limitations of the current literature. Most of the included studies focused on different specific aspects of sleep (e.g. sleep problems, sleep habits, architecture, duration, circadian preference, sleep quality), reporting on a range of different variables measured using very different instruments. In addition to this, data are always reported together for both male and female participants, and thus gender specific differences, such as circadian differences, were unable to be assessed. Furthermore, the heterogeneity of the sleep assessment methods represent a limitation for this systematic review (structured interviews at parents, sleep diaries, actigraphy, polysomnography). Particularly, few studies used objective measures and few studies used sleep diaries, while the majority of the included studies assessed sleep parameters and habits with the use of questionnaires and interview. Moreover, results from this systematic review suggested that preschoolers and school-aged children, when assessed with objective measures of sleep, presented less TST with respect to when assessed with parent-reported sleep measures. As a result of these limitations, the review is unable to provide a comprehensive overview of the full range of sleep characteristics in the different age and sex groups. Future epidemiological studies are needed that would comprehensively assess sleep characteristics for all pediatric populations.

Clinical implications and guidelines

This systematic review highlights a concerningly high prevalence of unhealthy sleep patterns and habits in the Italian pediatric population. It is of the utmost importance to clinically address and identify sleep problems and to provide effective preventative intervention and education in both pediatric primary and secondary care. This may be best provided for by considering the inclusion of a sleep specialist clinical psychologist in pediatric primary care who is able to liaise with schools and provide evidence-based clinical support to parents and children who present with sleep-related problems. Previous findings from other countries have already highlighted this problem. For example, in a systematic review by Gruber and colleague (2017), 15 school-based sleep health promotion programs were assessed. Their findings indicated that despite some sleep education programs having been successful in increasing the level of sleep-related knowledge, several programs were ineffective at engendering any behavioral change, with no program that was able to maintain any change at follow up. That is, preventative programs may increase knowledge and sensitivity to these problems in the population but evidence-based clinical support should also be routinely provided.

Figure 2. *Main outcomes for the different age groups*



Supplemental material

Prisma 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-9
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	9
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	n.a.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	10
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	10-11
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	10-11
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	10-11
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	11-12
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	11-12
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	11-12
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n.a.
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n.a.
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	n.a.
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n.a.
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	12
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	12-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	14
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	14-19
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n.a.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n.a.
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n.a.
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	20-24
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	22-23
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	24
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	n.a.

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Quality assessment

Author	Year	Sample size (n =)	Population	Age range	Mean age	Age category	Gender (% female)	Region	Fathers' occupationMothers' occupationFathers' age (Years) Mothers' age (Years)Family typeParenthood
Bacaro, V., Feige, B., Ballesio, A., De Bartolo, P., Johann, A. F., Buonanno, C., ... & Baglioni, C.	2019	65	General	02-36 months	19.6 ± 9.60 months	Infancy + toddlerhood	53,80%	All territory	Not reportedNot reported38,235Biological with all parents61.5% Firstborn
Bacaro, Valeria; Feige, Bernd; Benz, Fee; Johann, Anna F.; Bartolo, Paola de; Devoto, Alessandra; Lombardo, Caterina; Riemann, Dieter; Baglioni, Chiara	2020	92	General	6-36 months	22.67 months	Infancy + toddlerhood	43%%	All territory	Not reportedNot reported38,4934,68Biological with all parents61% Firstborn
Bisogni, S.; Chiarini, I.; Giusti, F.; Ciofi, D.; Poggi, G. M.; Festini, F.	2015	201	Hospitalized children	0 - 2 years	11.2 ± 10.3 months	Infancy + toddlerhood	42,80%	Not reported	Not reportedNot reportedNot reported32,8Not reportedNot reported
Brambilla, Paolo; Giussani, Marco; Pasinato, Angela; Venturelli, Leonello; Privitera, Francesco; Miraglia Del Giudice, Emanuele; Sollai, Sara; Picca, Marina; Di Mauro, Giuseppe; Bruni, Oliviero; Chiappini, Elena	2017	2030	General	1-14 years	5.25 years	Infancy + toddlerhood + school aged + pre adolescent	49,40%	47% north italy; 17% centre italy; 36% south italy	1848 emplyed828 employedNot reportedNot reportedNot reportedNot reported
Brunetti, L.; Rana, S.; Lospalluti, M. L.; Pietrafesa, A.; Francavilla, R.; Fanelli, M.; Armenio, L.	2001	1207	General	03-11 years	7.3 years	Toddlerhood + preschoolers + school aged	51%	Puglia	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Bruni, O.; Fabrizi, P.; Ottaviano, S.; Cortesi, F.; Giannotti, F.; Guidetti, V.	1997	283	Headache patients	5-14 years	10.11 years	School aged + adolescent	49,10%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Bruni, Oliviero; Ferri, Raffaele; Miano, Silvia; Verrillo, Elisabetta; Vittori, Elena; Della Marca, Giacomo; Farina, Benedetto; Mennuni, Gioacchino	2002	10	Healthy	6-10 years	8.3 years	School aged	40,00%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Bruni, Oliviero; Ferri, Raffaele; Miano, Silvia; Verrillo, Elisabetta; Vittori, Elena; Farina, Benedetto; Smerieri, Arianna; Terzano, Mario Giovanni	2005	10	Healthy	3-6 years	4.6 years	Preschoolers	60,00%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Bruni, O.; Russo, P. M.; Ferri, R.; Novelli, L.; Galli, F.; Guidetti, V.	2008	1073	General	8-15 years	10.5 years	School aged + adolescent	49,10%	Lazio	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Bruni, Oliviero; Novelli, Luana; Finotti, Elena; Luchetti, Anna; Uggeri, Giordana; Aricò, Debora; Ferri, Raffaele	2009	32	Healthy	2.9-10.3 years	6.4 years	Preschoolers + school aged	43,70%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported

Quality assessment

Bruni, Oliviero; Baumgartner, Emma; Sette, Stefania; Ancona, Mario; Caso, Gianni; Di Cosimo, Maria Elisabetta; Mannini, Andrea; Ometto, Mariangela; Pasquini, Anna; Ulliana, Antonella; Ferri, Raffaele	2014	704	Healthy	1-12 months	Not reported	Infancy	49,30%	All territory	Not reportedNot reportedNot reportedNot reportedBiological with all parents except for 4 (1= only mother; 3= separated)43.9% sfirst born
Bruni, Oliviero; Sette, Stefania; Fontanesi, Lilybeth; Baiocco, Roberto; Laghi, Fiorenzo; Baumgartner, Emma	2015	850	General	11-16 years	13.5 years	Adolescent	57,10%	Lazio	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Bruni, Oliviero; Melegari, Maria Grazia; Esposito, Alice; Sette, Stefania; Angriman, Marco; Apicella, Marina; Caravale, Barbara; Ferri, Raffaele	2020	167	Healthy	24-71 months	44.3 months	Preschoolers	51%	Lazio	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Chindamo, Sonia; Buja, Alessandra; DeBattisti, Elisa; Terraneo, Alberto; Marini, Elena; Gomez Perez, Luis Javier; Marconi, Linda; Baldo, Vincenzo; Chiamenti, Gianpiero; Doria, Mattia; Ceschin, Flavia; Malorgio, Emanuela; Tommasi, Mara; Sperotto, Milena; Buzzetti, Roberto; Gallimberti, Luigi	2019	1117	Healthy	12-23 months	25.3 months	Toddlerhood	48,70%	All territory	Not reportedNot reported37,534,3Not reported50.4% first born
Cortesi, Flavia; Giannotti, Flavia; Sebastiani, Teresa; Vagnoni, Cristina	2004	901	Healthy	6.1-11.9 years	8.4 years	School age	53,30%	Lazio	not reportednot reportednot reportedNot reported44 had single parents; 64 first born
Cortesi, Flavia; Giannotti, Flavia; Sebastiani, Teresa; Vagnoni, Cristina; Marioni, Patrizia	2008	376	Sleep problem	5-9 years	Co_sleepers: 6.3; solitary sleepers: 6.2 years; control: 5.11 years	School age	Co_ sleepers: 46% solitary sleepers: 48%; control: 52%	Lazio	not reportednot reportedNot reported 259 biological with all parents102 first born
Cortesi, Flavia; Giannotti, Flavia; Sebastiani, Teresa; Panunzi, Sara; Valente, Donatella	2012	160	With autistic disorder diagnosis	4-10 years	6.6 years	Preschoolers + School age	Not reported	Lazio	Not reportedNot reportedNot reported34,289% marriedNot reported
D'Aniello, Roberta; Troisi, Jacopo; D'Amico, Osvaldo; Sangermano, Maria; Massa, Grazia; Moccaldo, Anna; Pierri, Luca; Poeta, Marco; Vajro, Pietro	2015	54	Normal, overweight and obesity	5-16 years	9.8 years	School aged + Adolescent	Not reported	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Fazzi, Elisa; Zaccagnino, Maria; Capsoni, Chiara; Orcesi, Simona; Spada, Giulia; Cavallini, Anna; Caffi, Lorella; Bianchini, Lucia; Montrasio, Vincenzo; Zambonin, Fabio	2006	50	General	10-39 months	22.94 months	Toddlerhood	46%	Piedmont	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported

Quality assessment

Ferranti, Roberta; Marventano, Stefano; Castellano, Sabrina; Giogianni, Gabriele; Nolfo, Francesca; Rametta, Stefania; Matalone, Margherita; Mistretta, Antonio	2016	1586	General	11-14 years	12 years	Adolescent	45%	Sicily	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Ficca, Gianluca; Conte, Francesca; Padova, Vittoria de; Zilli, Iole	2011	465	General without learning disorder	6-12 years	Not reported	School aged	49,60%	Campania	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Giannotti, Flavia; Cortesi, Flavia; Sebastiani, Teresa; Ottaviano, Salvatore	2002	742	General	14.1-18.6 years	16.8 years	Adolescent	42%	All territory	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Giganti, Fiorenza; Arzilli, Cinzia; Conte, Francesca; Toselli, Monica; Viggiano, Maria Pia; Ficca, Gianluca	2014	23	General	38-70 months	52.6 months	Preschoolers	43%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Manni, R.; Ratti, M. T.; Marchioni, E.; Castelnovo, G.; Murelli, R.; Sartori, I.; Galimberti, C. A.; Tartara, A.	1997	1226	General	n.a.	17 years	Adolescent	60%	Lombardy	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Melegari, Maria Grazia; Vittori, Elena; Mallia, Luca; Devoto, Alessandra; Lucidi, Fabio; Ferri, Raffaele; Bruni, Oliviero	2020	21	Healthy	48-69 months	5.1 Years	Preschoolers	n/a	Lazio	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Russo, Paolo M.; Bruni, Oliviero; Lucidi, Fabio; Ferri, Raffaele; Violani, Cristiano	2007	1073	General	8-14 years	10.6 years	School aged + Adolescent	49,20%	Lazio	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Russo, Paolo M.; Biasi, Valeria; Cipolli, Carlo; Mallia, Luca; Caponera, Elisa	2017	3463	General	Not reported	13.8 years	Adolescent	50,40%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported
Sette, Stefania; Baumgartner, Emma; Ferri, Raffaele; Bruni, Oliviero	2017	704	Healthy	3-12 months	Not reported	Infancy	49,30%	Not reported	Not reportedNot reportedNot reportedNot reportedNot reported43.9% first born
Zaccari, V.; Santonastaso, O.; Mandolesi, L.; Crescenzo, F. de; Foti, F.; Crescentini, C.; Fabbro, F.; Vicari, S.; Curcio, G.; Menghini, D.	2021	32	With ADHD diagnosis	7–11years	Not reported	School age	28,00%	Lazio	Not reportedNot reportedNot reportedNot reportedNot reportedNot reported

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References

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