INPLASY PROTOCOL

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None declared.

Could local sleep explain the occurrence of attentional lapses in primary school-aged children? A scoping review protocol

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Review question / Objective: The current review aims to describe the literature on the relationship between local sleep and attentional lapses in neurotypical children or children with ADHD and how this can be applied to inform our understanding of poor attention under conditions of low arousal and increased sleep pressure. The main/primary question is, what is known from the existing literature about the relationship between local sleep and attentional lapses in children? In answering this primary question, we also want to know under what conditions is local sleep occurring? For example, does local sleep occur more frequently with increased fatigue?

Eligibility criteria: All papers identified must meet the following criteria for inclusion: the population is neurotypical children and children with ADHD aged between 6 and 12 years of age, published in English, full text available (where full-text is not available, authors will be contacted to request a copy of the paper). All time frames, types of sources (e.g. qualitative or quantitative research studies), geographic locations, cultural and sociodemographic contexts will be included. Review papers (i.e. systematic reviews, meta-analyses), papers with animal studies and clinical cohorts other than ADHD (e.g. autism, sleep disorders, acquired brain injuries etc.) will be excluded. As local sleep is defined as occurring during wakefulness, studies with participants who are asleep will also be excluded.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 19 December 2022 and was last updated on 19 December 2022 (registration number INPLASY2022120074).

INTRODUCTION

Review question / Objective: The current review aims to describe the literature on the relationship between local sleep and attentional lapses in neurotypical children or children with ADHD and how this can be applied to inform our understanding of poor attention under conditions of low arousal and increased sleep pressure. The

main/primary question is, what is known from the existing literature about the relationship between local sleep and attentional lapses in children? In answering this primary question, we also want to know under what conditions is local sleep occurring? For example, does local sleep occur more frequently with increased fatigue?

Background: The ability to sustain attention is critical for the processing of behaviourally or task-relevant information (Esterman & Rothlein, 2019). In children, the inability to sustain attention is associated with poorer learning outcomes, peer relationships and mental health (Rueda et al., 2010). Previous attentional research has focused on the role of neural networks such as the dorsal frontoparietal network, ventral network and default mode network to explain the ability to maintain attentional control (Cortese et al., 2012; Tegelbeckers et al., 2015). The research has highlighted that arousal plays a critical role in modulating attention, whereby at moderate levels of arousal attentional networks interact to facilitate attentional control (Howells et al., 2012; Sara & Bouret, 2012). However, at excessively low and high arousal levels the neural networks involved in attentional control are not effectively modulated producing lapses in attention (Howells et al., 2012; Sara & Bouret, 2012). This is consistent with evidence that people have difficulties paying attention when they are fatigued such as following a poor night's sleep or why symptoms of attentional disorders such as attention deficit hyperactivity disorder (ADHD) are thought to be explained by hypoarousal or a dysregulation of arousal (Clarke et al., 2019).

While it is clear that arousal plays a role in attention, because it modulates the neural networks involved in attentional control, it is not clear what mechanism is at play when arousal levels are too low or high and how this relates to differences in the type of attentional lapse experienced. Recently, there has been increased interest in the role of local sleep in attention. Local sleep is the brief and localised occurrence of brain waves during wakefulness that resemble those that typically occur during sleep (Andrillon et al., 2019; D'Ambrosio et al., 2019). Local sleep is thought to be associated with neuronal silencing that can account for task-specific deficits that correspond with the brain region where local sleep occurs (D'Ambrosio et al., 2019). Previous studies have found that local sleep may be associated with attentional lapses (Andrillon et al., 2021; Wienke et al., 2021). There is some evidence that local sleep in frontal brain regions predicts impulsivity (Andrillon et al., 2021) and mind wandering (task-irrelevant thoughts; Andrillon et al., 2021; Wienke et al., 2021). Comparatively, local sleep in posterior regions may predict inattention and mind blanking (the temporary absence of thought; Andrillon et al., 2021). Local sleep occurs at a greater frequency during periods of low cortical arousal (e.g. at the end of the day, after a difficult task, when the person is generally tired) and following poorer sleep quality and quantity (Andrillon et al., 2021; D'Ambrosio et al., 2019). Previous research has established a link between attentional lapses and both states of low arousal and sleep issues; however, the mechanisms responsible for this relationship are not clear. The increased occurrence of local sleep at low arousal and following poor sleep suggests that local sleep could be the mechanism responsible for attentional lapses.

Rationale: The neural mechanisms that underpin attentional lapses and the type of attentional lapses that occur are not yet clear. Recently, there has been increased interest in the role of local sleep in understanding what is happening in the brain when people experience attentional lapses (Andrillon et al., 2019; Andrillon et al., 2021; Wienke et al., 2021). However, as the concept of local sleep is relatively new, further analysis of the literature is required to facilitate our understanding of this field. While a number of recent narrative reviews (Andrillon et al., 2019; D'Ambrosio et al., 2019; Siclari & Tononi, 2017) have explored local sleep research in adults, a systematic review approach was not utilised. The current reviews on local sleep only provide an overview of the concept and do not

systematically evaluate the empirical evidence for the relationship between local sleep and attention. Further, to the best of our knowledge, no review systematic or otherwise has examined the evidence of local sleep and attention in children. It is important to review the literature on local sleep in children to investigate whether and how this mechanism operates in children. This needs to be considered as children have different circadian rhythms to adults (Skeldon et al., 2015) that might influence their daytime arousal (Schmidt et al., 2012) and thus the occurrence of local sleep.

METHODS

Strategy of data synthesis: The proposed scoping review will be conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018). The scoping review will be guided by Arksey and O'Malley's (2005) methodological framework and enhanced by Levac et al. (2010).

A comprehensive and systematic search of the literature will be undertaken using a range of online databases, including EMBASE, CINAHL, MEDLINE, PsychINFO, PubMed and SCOPUS. To ensure that the review of the literature is comprehensive and rigorous, the search strategy will involve both keywords and subject heading searches in the relevant databases. The two concepts of our research questions are 1) local sleep and 2) attention. The population of interest is healthy school-aged children and children with attention deficit hyperactivity disorder (ADHD; 6-12 years). The search strategy included key terms defining the population and concepts of the research question. The search terms included "local sleep" OR "slow wave*" OR "SWA" OR "neural*" OR "neuron*" OR "electroencephalogram" OR "EEG" AND "attent*" OR "Cognit*" OR "mind wander*" OR "mind blank*" OR "impulsiv*" OR "hyperactiv*" OR "inattention" OR "omission error" OR "commission error" "response time" OR "response speed" OR "sustained attention" AND "child*" OR "kid" OR "youth" OR "teen*" OR "school*"

OR "pediatric*" OR "paediatric*". A hand search of the grey literature will also be conducted to identify relevant studies that may have been missed in the initial search. The search strategy was developed through discussion with the research team and consultation with a librarian. The search strategy will be piloted to confirm that the search is comprehensive and appropriately addresses the research questions.

Eligibility criteria: All papers identified must meet the following criteria for inclusion: the population is neurotypical children and children with ADHD aged between 6 and 12 years of age, published in English, full text available (where full-text is not available, authors will be contacted to request a copy of the paper). All time frames, types of sources (e.g. qualitative or quantitative research studies), geographic locations, cultural and sociodemographic contexts will be included. Review papers (i.e. systematic reviews, meta-analyses), papers with animal studies and clinical cohorts other than ADHD (e.g. autism, sleep disorders, acquired brain injuries etc.) will be excluded. As local sleep is defined as occurring during wakefulness, studies with participants who are asleep will also be excluded.

Source of evidence screening and selection: All papers identified (including duplications) will be stored, organised, and managed using Endnote (The Endnote Team, 2013). A two-step screening process will be undertaken using Covidence software (Verital Health Innovation, n.d.) with two reviewers at each stage to ensure rigor. At stage 1, all titles and abstracts retrieved from the search will be screened for relevance. All titles and abstracts will be screened by the primary author, whilst one other author will screen approximately 40%, chosen at random. Cohen's Kappa will be used to determine the percentage of agreement between authors, and all disagreements will be resolved by a third author. In the second stage, full-text screening of the remaining articles will be deployed against the inclusion criteria. The primary author will screen all articles, with

approximately 40% screened by one other author. Again any disputes will be resolved by a third author. A quality assessment of the identified articles will also be conducted using a modified version of the National Health and Medical Research Council (NHMRC; Hillier et al., 2011) form and the International Centre for Allied Health Evidence (iCAHE) Guideline Quality Checklist (Grimmer et al., 2014). A PRISMA flowchart detailing the review process including the number of papers identified, included, excluded and the reasons for exclusion at each stage of the selection process will be presented.

Data management: Data will be extracted from the included studies using a data charting form in Excel to create a descriptive summary of the studies and their results. The data charting form will be adapted by the authors from the Joanna Briggs Institute (JBI) data extraction form (Peters et al., 2020) to extract variables that address the research questions. Key variables that will be extracted include the author(s), study title, year of publication, study location and populations, study aims, methodology, outcome measures and key findings. This will be an iterative process as additional relevant information may be identified during the charting process. The data extraction process will be piloted by two authors on the first three studies selected to ensure that the data extracted addresses the research questions.

Presentation of the results: The results of the data extraction will be collated and summarised in a tabular format based on the research questions. The results will be accompanied by a narrative summary that describes the results as they relate to the research questions. Gaps in the research will be identified and recommendations will be made for future research.

Language restriction: English.

Country(ies) involved: Australia.

Keywords: local sleep; attention; child.

Dissemination plans: It is anticipated that the results of the review will be published in a peer-reviewed journal.

Contributions of each author:
Author 1 - Olivia Penman - Conceptualisation of the review, literature search, study screening, data extraction, summarising and reporting results, drafting manuscript and approval of the final manuscript.
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