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Behind closed eyes: Understanding nightmares in children and adolescents with autism spectrum disorder – A systematic review

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ABSTRACT

Introduction: Brain and sleep development in childhood shapes emotional and cognitive growth, including the ability to recall dreams. In line with the continuity hypothesis of dreaming, several findings suggest a link between clinical symptoms and nightmare frequency. Sleep disorders and anxiety are among the most frequently co-occurring conditions in children and adolescents with autism spectrum disorder (ASD). However, their impact on nightmares has not yet been systematically explored.

This review aims to address this research gap by investigating nightmares in autism and their influence on clinical symptoms and cognitive functioning.

Methods: The literature was searched utilizing the databases PubMed, PsycINFO, Web of Science, and Scopus, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The included studies were assessed for methodological quality.

Results: Twenty-nine papers were reviewed. The prevalence of nightmares occurring very frequently was below 5 %, with no significant difference in nightmare prevalence between children with ASD and their healthy peers. Furthermore, several findings reported a relationship between nightmares and other sleep disturbances among individuals with ASD.

Discussion: The study of dreaming in ASD may provide valuable insights into the disorder. Although comorbid sleep disorders can influence nightmare frequency, the results of this review suggest that nightmares may not represent a distinctive feature of ASD. However, poor communication and introspection skills may explain the difficulties in reporting dream experiences.

Given the preliminary nature of current research on nightmares in ASD, further studies are essential to overcome existing limitations and deepen our understanding.

1. Introduction

The maturation of brain processes and sleep patterns during childhood plays a vital role in determining the individual's level of functioning. The ability to produce and recall dreams also relies on the integrity of the neurocognitive system (Solms, 1997, 2000). In particular, the development of cognitive processes in children may underlie the maturation of the oneiric content and the ability to recall dreams (Mangiaruga et al., 2018). In this regard, numerous studies carried out on both children and adults (see Mangiaruga et al., 2018; Scarpelli et al., 2021, 2022a for reviews) supported the hypothesis of the existence of continuity in the cognitive and neurobiological functioning between waking and dreaming (Hall, 1953; Bell and Hall, 1971). Thus, it could be argued that the relationship between distressing dreams and impaired daytime functioning lies at one end of this dream-wake continuum.

The ICSD-3 (American Academy of Sleep Medicine, 2014) and DSM-5 (American Psychiatric Association, 2013) define nightmares as extremely dysphoric dreams, often involving attempts to avoid threats to the survival or physical integrity of the sleeper (for a comprehensive definition of nightmares and related phenomena, as well as the methodologies employed to investigate nightmares in children, refer to Table 1).

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Table 1
Definitions of nightmares and related phenomena, and description of methods used for nightmare assessment.

DSM−5 definitions (American Psychiatric Association, 2013)		Similarities and differences with nightmares
Nightmares: well-remembered, extremely dysphoric dreams that may result in awakening		
Bad dreams: dreams with distressing content not followed by awakening		Nightmares usually result in awakening, while bad dreams, despite having similarly disturbing content, do not lead to waking. Since nightmares and bad dreams share certain phenomenological similarities, it remains an open question whether they are two distinct phenomena or the same phenomenon that varies in intensity (Levin and Nielsen, 2007).
Night terrors: sudden awakenings from sleep with terror and motor behavior (e.g., screaming), followed by little or no recall of the event or the dream experience		Both nightmares and night terrors involve full or partial awakenings from sleep accompanied by fear and autonomic activation. However, they are distinct phenomena, typically occurring during different sleep stages. While individuals waking from nightmares appear alert, oriented, and able to recall the dream, night terrors generally result in partial awakenings, often accompanied by complete amnesia of the event and any associated dream experience. Furthermore, since night terrors typically occur during childhood (Petit et al., 2015), they may be mistaken for nightmares, especially when the latter are measured through parent-reports.
Methods for collecting nightmares in children	**Advantages**	**Disadvantages**
Prospective: require participants to report whether they have experienced nightmares upon awakening (e.g., through dream diaries filled in every morning)	• Provide a more accurate assessment of nightmare frequency by recording nightmares as they occur. • Are less prone to memory bias. • Allow for the measurement of nightmare frequency over extended periods of time.	• More time-consuming for participants and researchers. • Higher risk of poor adherence or dropout.
Retrospective: require participants to estimate the number of nightmares experienced in the past (e.g., filling in questionnaires/items or undergoing interviews)	• Cost-effective and less time-consuming for both researchers and participants. • Better suited for large sample sizes.	• More prone to memory bias or distortions. For instance, it was reported that retrospective tools may underestimate nightmare frequency compared to prospective assessments (Robert and Zadra, 2008). • May not provide a full picture of nightmare frequency, depending on the available response options in the tool used (e.g., Likert scales with fewer response choices may provide a less comprehensive picture of nightmare frequency, in contrast to those with multiple temporal frequency options).
Self-report: require children to provide information about their nightmares (e.g., via questionnaires, items or interviews administered directly to them)	Can capture the child's personal experience of nightmares.	May sometimes provide less reliable measures of nightmare frequency and content, especially in the case of younger children who may not fully understand what nightmares are or may fill in narratives with waking fantasies (Sándor et al., 2015).
Parent-report: require parents to provide information about their children's nightmares (e.g., through interviews, questionnaires, items, or dream diaries filled in by caregivers)	Are not subject to motivation or cooperation issues that may arise during test situations involving children (Nordahl-Hansen et al., 2014).	Children may not always inform their parents when they experience nightmares. Consequently, parent-reported measures of nightmare frequency may underestimate the actual prevalence of nightmares in children, as suggested by the existing literature (Schredl et al., 2009a).

Nightmare disorder is a type of parasomnia (American Psychiatric Association, 2013; American Academy of Sleep Medicine, 2014). It is characterized by dysphoric dreams leading to rapid orientation and alertness upon waking, causing clinically significant distress that cannot be attributed to substance use or other clinical conditions. Based on the duration of symptoms, nightmare disorder is classified as acute if lasting one month or less, subacute if it lasts between one and six months, and persistent if lasting six months or more. Severity is determined by the frequency of nightmares, with mild cases occurring less than once a week, moderate cases involving one or more weekly episodes, and severe cases occurring nightly (American Psychiatric Association, 2013). When considering nightmare frequency, the literature generally identifies frequent nightmares as those occurring at least once a week (Li et al., 2010, 2011; Schredl et al., 2016; Wang et al., 2023; Schredl, 2024), emphasizing their impact on psychopathological symptoms (Li et al., 2010, 2011; Wang et al., 2023).

Furthermore, idiopathic nightmares, defined as those with an unknown etiology, appear to be prevalent during puberty and tend to decrease in frequency with the transition to adulthood (El Sabbagh et al., 2023).

Evidence favoring the continuity hypothesis encompasses numerous studies conducted on children describing an association between anxiety symptoms, emotional dysregulation, and nightmare frequency. In addition, behavioral problems and attention deficits also seem to contribute to the occurrence of nightmares (for review, see Gauchat et al., 2014).

In light of the emerging theoretical background, it is worth investigating further the occurrence of nightmares and their association with daytime functioning in children exhibiting atypical trajectories of emotional, cognitive, and social development. Among neurodevelopmental disorders, autism is remarkably prevalent in the pediatric population, affecting about 1.4 % of children and adolescents aged 5–18 years in Europe (Sacco et al., 2022), and approximately 1/100 children worldwide (Zeidan et al., 2022).

In addition to the well-documented deficits in executive functions (Demetriou et al., 2019), autism often co-occurs with symptoms of

anxiety and depression (Bougeard et al., 2021).

In their model explaining the etiology of nightmares, Levin and Nielsen (2007) proposed that nightmares may result from both state factors, such as daily fluctuations in stress or negative emotions prompted by adverse situations (i.e., affective load), and personality traits, namely the predisposition to respond to events with heightened emotional reactivity (i.e., affective distress). In support of this model, the literature suggests an association between nightmare frequency and increased life stress (Wood et al., 1992; Nielsen et al., 2006; Sandman et al., 2013; Scarpelli et al., 2022b), as well as neuroticism (Zadra and Donderi, 2000; Schredl, 2003; Schredl and Göritz, 2021), thin boundaries (Pietrowsky and Köthe, 2003; Schredl, 2003), and trait anxiety (Gratton et al., 2024), which are dispositional characteristics closely linked to emotional distress. The latter appears to be particularly relevant in autism, as persons with ASD tend to exhibit higher levels of anxiety traits (Jolliffe et al., 2023) and reduced emotional stability (Lodi-Smith et al., 2019) compared to healthy controls. Therefore, nightmares might be expected to occur in this clinical population.

Insomnia is also a common comorbidity among individuals with ASD as almost two-thirds of children suffer from chronic insomnia (Souders et al., 2017). In fact, sleep problems, including difficulty falling asleep, frequent nocturnal awakenings, early morning awakenings, and restless sleep, are highly prevalent, affecting between 64 % and 93 % of this clinical population (Carmassi et al., 2019).

These findings are further supported by a meta-analysis of polysomnographic studies, which revealed a decline in sleep efficiency, increased time spent in stage 1 sleep and sleep onset latency, prolonged wake after sleep onset, and decreased REM sleep duration (Díaz-Román et al., 2018). In addition, other sleep disorders commonly observed in children with ASD include parasomnias (Liu et al., 2006; Carnett et al., 2021; Scarpelli et al., 2024) and excessive daytime sleepiness (Liu et al., 2006; Scarpelli et al., 2024).

Considering the abovementioned findings, it seems reasonable to hypothesize that the disrupted sleep patterns observed in individuals with ASD may affect the nature of their mental activity during sleep. Indeed, research on typically developing children showed that symptoms of sleep disorders, such as insomnia, difficulty falling asleep, night awakenings, and parasomnias, may increase nightmare frequency (Gauchat et al., 2014; Delage et al., 2024).

With this in mind, the investigation of nightmares in ASD may provide valuable insights into the relationship between dreaming and daytime functioning, as well as clarify whether and to what extent nightmares are clinically relevant in this population. Although many studies highlighted a high prevalence of nightmares in patients with mental disorders (for review, see Lemyre et al., 2019), to date no research work has systematically examined the occurrence of nightmares in ASD.

Therefore, this systematic review represents the first in-depth attempt to investigate the occurrence of nightmares in children and adolescents with ASD and to explore their relationship with clinical symptoms and cognitive functioning. First and foremost, we presented an overview of the current evidence on nightmares and distressing dreams in autism, with a detailed analysis of the prevalence of these oneiric experiences. Following this, we compared nightmare prevalence between children with ASD, their typically developing peers (TD), and other clinical groups, and explored factors that might underlie their occurrence in the disorder, particularly clinical symptoms and cognitive abilities.

We aimed to provide the reader with a comprehensive summary of the existing literature, highlighting its methodological limitations and open issues, and identifying areas in which further investigation is needed.

2. Methods

2.1. Search strategy

This systematic review adheres to the PRISMA guidelines (Moher et al., 2015; Page et al., 2021) and was added to the PROSPERO registry at the screening stage with the registration number CRD42024513497.

One author systematically searched the literature up to March 2024, utilizing the databases: PubMed, PsycINFO, Web of Science, and Scopus, with the following search string: (nightmare* OR dream* OR parasomnia* OR sleep disorder* OR sleep disturb* OR sleep problem*) AND (autis* OR Asperg* OR ASD OR "neurodevelopmental disorder" OR "pervasive developmental disorder").

The search field was limited to title or abstract, and English language. All studies available up to March 2024 were considered.

The records were imported into Zotero, a reference manager software, and duplicates were automatically removed. Any duplicates missed were further manually excluded (see Fig. 1).

2.2. Studies selection

The evaluation of the articles was conducted using a two-step procedure. Initially, potentially relevant publications were assessed by screening the titles and abstracts to meet the following criteria: 1) focus on sleep problems of individuals with neurodevelopmental disorders, pervasive developmental disorder, or ASD, 2) experimental (e.g., RCT, non-randomized controlled trials) or observational (e.g., cross-sectional, case-control, longitudinal) study design, 3) peer-reviewed articles, and 4) studies written in English.

Subsequently, the full text of articles that met the inclusion criteria was reviewed, and papers of dubious relevance were also fully examined. Full texts that were unavailable were requested by contacting the study's first author via email. The following eligibility criteria were applied: 1) examination of nightmare/bad dreams prevalence and/or the association between nightmares/bad dreams, clinical symptoms, and cognitive functioning, 2) children and/or adolescents with ASD (aged $\leq$ 18 years) as the target population, 3) presence of a clinical diagnosis of ASD confirmed before entering the study or occurred in the past and reported by parents.

The first author (EP) screened the records obtained from the literature search by title and abstract and reviewed the full texts. The second author (SS) was consulted to resolve any doubts about the relevance of certain papers, and disagreements between the two authors were resolved by consulting a third reviewer (VA).

2.3. Data extraction

For each study that met the inclusion criteria, one author (EP) extracted and tabulated the following information: author and year of publication, recruitment methods and inclusion/exclusion criteria, study design, characteristics of the clinical samples, and any group of healthy controls (sample size, sex, age of participants, comorbid diagnoses and medications), procedure by which nightmares/bad dreams were measured and operationalized, percentage of nightmares/bad dreams and/or type of associations found with clinical symptoms or cognitive functioning (see Table 2 and S2 Table in Supplementary Materials). Other information and potentially useful data were extracted from the supplementary materials of the included papers.

A second author (SS) verified the extracted data and discussed any discrepancies with the first author, particularly in cases where the data was unclear or absent. Any disagreements between the two authors were resolved by a third reviewer (MG).

2.4. Assessment of risk of bias

The methodological quality of the included studies was assessed with

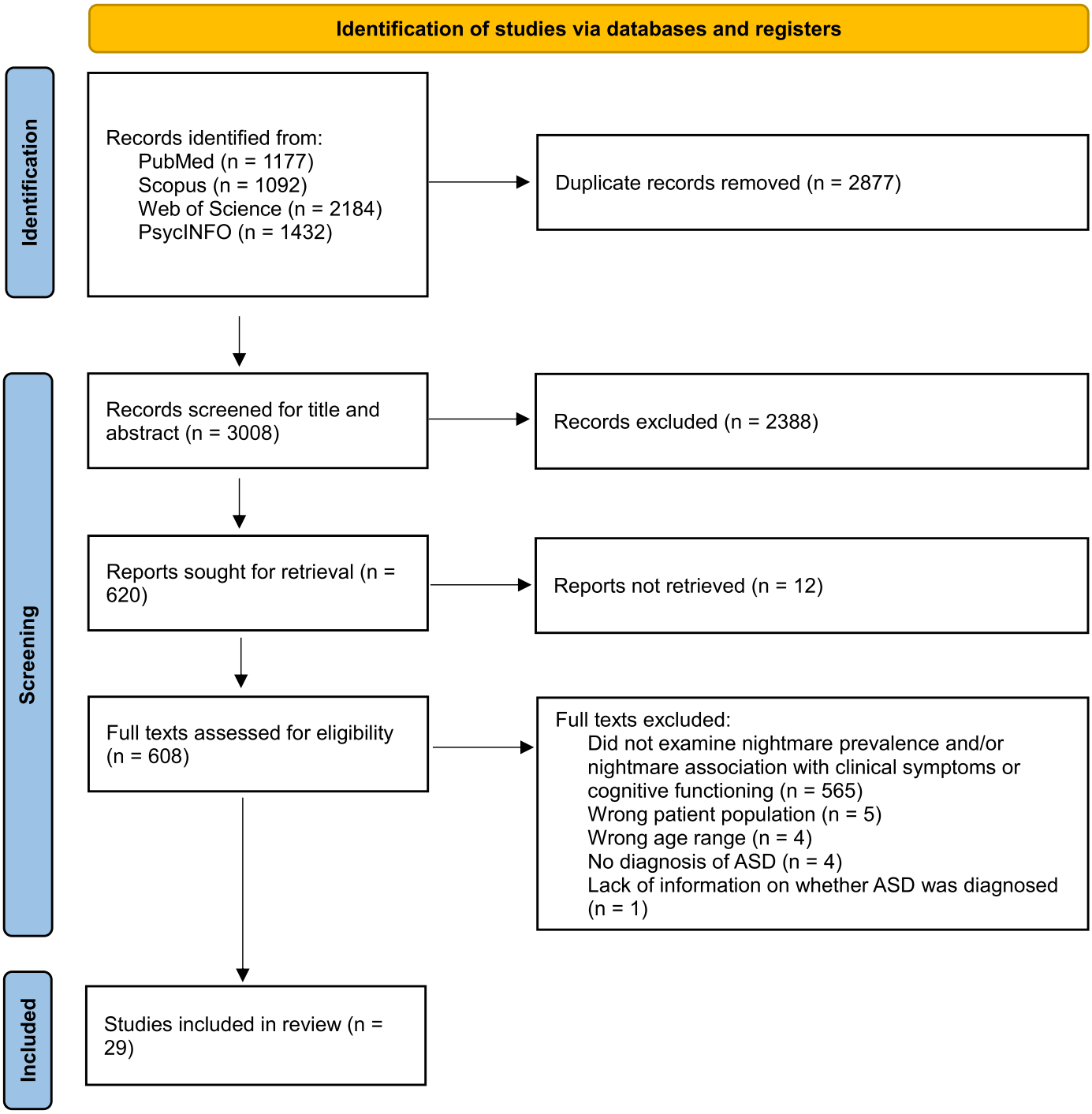

Fig. 1. PRISMA flow diagram.

the Newcastle-Ottawa Quality Assessment Scale for case-control studies (Wells et al., 2021). This scale consists of 8 items (see S1 Text in Supplementary Materials). Two researchers (EP and SS) independently assigned a score to each study using an Excel spreadsheet, according to three main criteria: the selection of study groups, the comparability of study groups, and the assessment of the exposure or outcome of interest. The two authors held regular discussions to resolve any inconsistencies or uncertainties in the rating of each study. In case of disagreement, a third party (VA) was consulted to reach a consensus.

The study quality was assessed using a star rating system, with a maximum of nine stars. Studies with a score of 0–3 were considered of poor quality, 4–6 of medium quality, and 7–9 of good quality.

3. Results

3.1. Results of the literature search and qualitative synthesis

The bibliographic search yielded a total of 5885 records. After the removal of duplicates, 3008 records underwent the first phase of screening by title or abstract, which resulted in the rejection of 2388 papers. A further 12 articles were discarded due to unavailability of the full text. In total, 608 full texts were screened according to the eligibility criteria, which led to the exclusion of 579 studies. The reasons for the rejection were as follows: 565 studies did not examine the prevalence of nightmares and/or the association between nightmares, clinical

symptoms, and cognitive functioning, 4 studies included participants over the age of 18, 4 studies assessed ASD symptoms using screening tools without providing a clinical diagnosis, and 1 study did not specify whether ASD was diagnosed. Five studies were excluded because they examined nightmares in samples that were not composed solely of children with ASD. Of these, 4 studies assessed nightmares in groups that included both individuals with ASD and patients with other neurodevelopmental disorders or clinical conditions, and 1 study reported nightmare frequency in a sample of both children with ASD and their TD peers, without differentiating nightmare frequency between the two groups.

Finally, 29 studies published between 1998 and 2024 met the eligibility criteria and were included in the qualitative synthesis. The mean score assigned to the studies was 4.52, indicating medium quality (see S1 Table in Supplementary Materials).

3.2. Characteristics of the included studies

All studies were conducted on participants diagnosed with autism. One study included children with ASD and attention deficit hyperactivity disorder (ADHD) in comorbidity (Reynolds et al., 2017), while another included individuals with ASD and anxiety disorders (Nadeau et al., 2015). Eight papers provided details on the diagnostic subtypes of ASD and reported recruiting children diagnosed with Asperger's syndrome (Patzold et al., 1998; Wiggs and Stores, 2004; Allik et al., 2006; Doo and Wing, 2006; Liu et al., 2006; Paavonen et al., 2008; Nadeau et al., 2015; Katz et al., 2018) and pervasive developmental disorder (Doo and Wing, 2006; Liu et al., 2006; Nadeau et al., 2015; Katz et al., 2018).

Fourteen studies included a control group of children and adolescents with typical development (Allik et al., 2006; Krakowiak et al., 2008; Paavonen et al., 2008; Reynolds et al., 2012; Chou et al., 2012; Tsai et al., 2012; Mutluer et al., 2016; Köse et al., 2017; Malhi et al., 2019; Kang et al., 2020; Bruni et al., 2021; Mughal et al., 2021; Tran et al., 2021; Wang et al., 2021), and seven studies recruited, in addition to the ASD group, samples of patients with other clinical conditions, such as ADHD (Tsai et al., 2012; Bruni et al., 2021), intellectual disability (ID) (Patzold et al., 1998; Krakowiak et al., 2008; Köse et al., 2017; Guller et al., 2021), communication disorders (Guller et al., 2021), specific learning disorders (Guller et al., 2021), fetal alcohol syndrome (Mughal et al., 2021), and epilepsy (Tsai et al., 2012).

The number of participants ranged from 55 (27 with ASD and 28 healthy controls) (Reynolds et al., 2012) to 1437 children with ASD (Katz et al., 2018). Participants in the ASD group ranged in age from 1 (Mayes and Calhoun, 2009; Bruni et al., 2022) to 18 years old (Liu et al., 2006; Bruni et al., 2021, 2022), while those in the healthy control group were between 2 (Krakowiak et al., 2008; Wang et al., 2021) and 18 years old (Bruni et al., 2021). Several studies recruited samples of both children and adolescents, except for fifteen works conducted on children under the age of 13 (Patzold et al., 1998; Allik et al., 2006; Doo and Wing, 2006; Chou et al., 2012; Reynolds et al., 2012, 2017; Johnson et al., 2016; Köse et al., 2017; Katz et al., 2018; Malhi et al., 2019; Sommers et al., 2024), and toddlers younger than 6 years (Krakowiak et al., 2008; Kang et al., 2020; Samanta et al., 2020; Wang et al., 2021). In all ASD samples, the number of males was higher than that of females. Notably, one study was only conducted on male participants (Samanta et al., 2020).

About half of the included studies measured the degree of cognitive functioning. Some papers reported recruiting children with ASD without ID (Allik et al., 2006; Reynolds et al., 2012; Tsai et al., 2012; Calhoun et al., 2020; Sommers et al., 2024), and others involved children with ASD both with and without comorbid ID (Patzold et al., 1998; Gail Williams et al., 2004; Doo and Wing, 2006; Krakowiak et al., 2008; Mayes and Calhoun, 2009; Johnson et al., 2016; Köse et al., 2017; Malhi et al., 2019).

In several studies, participants with ASD were receiving medicinal treatments (Patzold et al., 1998; Wiggs and Stores, 2004; Liu et al., 2006; Krakowiak et al., 2008; Mayes and Calhoun, 2009; Tsai et al., 2012; Nadeau et al., 2015; Köse et al., 2017; Katz et al., 2018; Calhoun et al., 2020; Tran et al., 2021; Sommers et al., 2024), in particular, stimulants (Wiggs and Stores, 2004; Mayes and Calhoun, 2009; Tsai et al., 2012; Nadeau et al., 2015; Köse et al., 2017; Sommers et al., 2024), antidepressants (Wiggs and Stores, 2004; Mayes and Calhoun, 2009; Tsai et al., 2012; Nadeau et al., 2015; Köse et al., 2017; Sommers et al., 2024), antipsychotics (Patzold et al., 1998; Wiggs and Stores, 2004; Mayes and Calhoun, 2009; Nadeau et al., 2015; Köse et al., 2017; Sommers et al., 2024), and melatonin (Wiggs and Stores, 2004; Mayes and Calhoun, 2009; Tran et al., 2021). Moreover, one study found that participants with ASD on sleep medication or stimulants had more severe sleep disorders than individuals with ASD not taking these medications (Mayes and Calhoun, 2009). Some papers also compared the proportion of participants taking medication between the ASD group and other clinical groups. In one study, the percentage of children with ASD taking drugs was higher than that of controls, some of whom had ID (Patzold et al., 1998), while another paper found no significant difference in drug intake between the ASD and ID groups (Köse et al., 2017). Further, the proportion of children with ASD under medication was lower in comparison to patients with epilepsy and ADHD (Tsai et al., 2012).

In contrast, other studies excluded children and adolescents with ASD who were taking medication or psychotropic drugs (Allik et al., 2006; Paavonen et al., 2008; Mutluer et al., 2016; Malhi et al., 2019; Kang et al., 2020), and those who were taking drugs that could affect sleep (Patzold et al., 1998; Samanta et al., 2020).

Concerning the presence of comorbidities, some studies recruited participants with ASD and co-occurring medical problems (Wiggs and Stores, 2004; Liu et al., 2006; Krakowiak et al., 2008; Köse et al., 2017), sleep disorders (Allik et al., 2006; Johnson et al., 2016; Calhoun et al., 2020; Sommers et al., 2024), neurological disorders and psychiatric comorbidities (Wiggs and Stores, 2004; Liu et al., 2006; Nadeau et al., 2015; Johnson et al., 2016; Köse et al., 2017; Reynolds et al., 2017; Sommers et al., 2024), specifically ADHD (Liu et al., 2006; Köse et al., 2017; Reynolds et al., 2017; Sommers et al., 2024), anxiety or depressive symptoms (Nadeau et al., 2015; Köse et al., 2017; Reynolds et al., 2017), obsessive-compulsive disorder (Nadeau et al., 2015; Reynolds et al., 2017), and disruptive behavior (Johnson et al., 2016; Reynolds et al., 2017).

On the other hand, other studies excluded children and adolescents with ASD who had other comorbidities (Reynolds et al., 2012; Tsai et al., 2012; Mutluer et al., 2016; Malhi et al., 2019; Kang et al., 2020; Samanta et al., 2020; Guller et al., 2021; Wang et al., 2021).

In most of the studies, dream variables were assessed using retrospective questionnaires administered to caregivers in written or oral forms (Wiggs and Stores, 2004; Köse et al., 2017), and only one study combined the use of a validated questionnaire completed directly by the children (Paavonen et al., 2008). The presence of nightmares was also assessed through telephone interviews with the caregiver (Tran et al., 2021), and sleep diaries filled in by parents (Patzold et al., 1998).

The results of each reviewed article are detailed in Table 2, while additional information including diagnostic assessment, comorbidities, and medications can be found in S2 Table (see Supplementary Materials).

3.3. Nightmare prevalence among children and adolescents with ASD

All the studies included in this systematic review provided estimates of nightmare prevalence. Several studies did not specify the frequency of nightmares and reported prevalence rates in children and adolescents with ASD ranging from 0.8 % to 17.8 % (Patzold et al., 1998; Chou et al., 2012; Tsai et al., 2012; Nadeau et al., 2015; Mutluer et al., 2016; Guller et al., 2021; Sommers et al., 2024).

Two studies investigated the prevalence of sleep problems, as defined by DSM-IV diagnostic criteria, and reported current (Chou et al.,

2012; Tsai et al., 2012) and lifetime nightmare prevalences of 11–17.5 % (Chou et al., 2012; Tsai et al., 2012) and 25 %, respectively (Tsai et al., 2012). Interestingly, the study by Tsai et al. (2012) also had the highest female-to-male ratio, as more than one-third of the recruited children were female, which may have influenced the results.

A limited number of studies found a remarkable presence of nightmares in ASD (~ 40 %) (Mayes and Calhoun, 2009; Calhoun et al., 2020; Mughal et al., 2021). One study did not mention the frequency considered for prevalence estimates (Mughal et al., 2021), whereas others found rates of 39 % (Mayes and Calhoun, 2009) and 47.9 % (Calhoun et al., 2020) for nightmares perceived as problematic sometimes or more frequently. Notably, these findings were observed in samples where many participants were on medication (Mayes and Calhoun, 2009; Calhoun et al., 2020) and suffered from other sleep disorders (Calhoun et al., 2020).

Among the other studies that specified nightmare frequency, some reported that 0–5.0 % of participants with ASD complained of having very frequent nightmares (Gail Williams et al., 2004; Allik et al., 2006; Liu et al., 2006; Krakowiak et al., 2008; Reynolds et al., 2012, 2017; Johnson et al., 2016; Köse et al., 2017; Malhi et al., 2019; Kang et al., 2020), also defined as occurring more than five times a week (Allik et al., 2006; Liu et al., 2006; Johnson et al., 2016; Köse et al., 2017; Kang et al., 2020). A larger proportion of participants, ranging from 17.4 % to 33.3 % experienced more occasional nightmares (Liu et al., 2006; Reynolds et al., 2012, 2017; Johnson et al., 2016). In particular, 24.7–33.3 % of respondents indicated that nightmares occurred "sometimes" without a specified weekly frequency (Reynolds et al., 2012, 2017). In contrast, studies that defined "sometimes" as "2–4 nights per week" described lower prevalence rates of approximately 17–21 % (Liu et al., 2006; Johnson et al., 2016). On the other hand, 76.8–92.75 % of participants reported having nightmares more rarely (Wiggs and Stores, 2004; Allik et al., 2006; Johnson et al., 2016; Katz et al., 2018), or "0–1 nights per week" (Johnson et al., 2016).

Studies that operationalized nightmares as dysphoric dreams followed by awakenings described a frequency of 0.4–5.0 % of nightmares occurring very frequently (Liu et al., 2006; Johnson et al., 2016; Köse et al., 2017; Malhi et al., 2019; Kang et al., 2020), or "5–7 times per week" (Liu et al., 2006; Johnson et al., 2016; Köse et al., 2017; Kang et al., 2020) and a prevalence of nightmares experienced "sometimes" or "2–4 times per week" ranging from 17.4 % to 21.2 % (Liu et al., 2006; Johnson et al., 2016). Instead, studies investigating the incidence of bad dreams reported higher prevalence rates, as 30–31 % of children with ASD complained of having frightening dreams "sometimes" or "usually" (Samanta et al., 2020), 19.2 % "more than twice a week" (Doo and Wing, 2006), and 39 % "rarely" (Samanta et al., 2020).

Only one study explored nightmare contents in ASD, revealing that the most frequently parent-reported oneiric theme was death or injury (11 %), followed by being chased (7 %) and sensing something scary (4 %). In addition, the authors of this study conducted a thematic analysis of the referred nightmares and found that themes related to separation, fantasy, real-life events, and violence, were among the most common (Mughal et al., 2021).

Only two studies explored the potential impact of age on the occurrence of nightmares (Mayes and Calhoun, 2009; Bruni et al., 2022). Although one study found no significant association between age and nightmares (Mayes and Calhoun, 2009), the other suggested that prevalence estimates may vary with age. More precisely, this research work examined nightmare prevalence across different age groups, focusing on the periods before and after the COVID-19 lockdown. It should be noted that none of the participants under the age of 6 reported having nightmares, suggesting that the onset of nightmares in ASD may occur at a later stage of development. The prevalence of nightmares was about 4.3 % in preadolescents aged 6–12 years, and 2.1 % in adolescents aged 13–18 years. These percentages increased during the lockdown periods, although without reaching statistical significance, rising to 8.5 % and 3.4 %, respectively, in the two age groups (Bruni et al., 2022).

Similarly, few studies investigated sexual dimorphism in the prevalence of nightmares among children and adolescents with ASD (Nadeau et al., 2015; Wang et al., 2021). Of these, one study found a higher presence of nightmares in females compared to males (Nadeau et al., 2015), whereas the other paper failed to find a significant difference between the sexes (16.6 % in females vs. 10.5 % in males) (Wang et al., 2021).

Furthermore, a limited number of studies shed light on the frequency of nightmares in relation to clinical treatments. In one paper involving participants with ASD with comorbid anxiety disorders, sleep patterns were assessed both before and after cognitive behavioral therapy (CBT), and the results showed a significant decline in nightmares from 34.8 % before to 12.8 % after CBT (Nadeau et al., 2015). Moreover, bad dreams were also assessed 8 and 24 hours after dental surgery, and a prevalence of 5.4 % was found at both time points (Tran et al., 2021).

3.4. *Comparing nightmare prevalence between children with ASD and their typically developing peers*

Twelve studies compared nightmare prevalence between children with ASD and their typically developing peers (Allik et al., 2006; Krakowiak et al., 2008; Paavonen et al., 2008; Chou et al., 2012; Tsai et al., 2012; Mutluer et al., 2016; Malhi et al., 2019; Kang et al., 2020; Bruni et al., 2021; Mughal et al., 2021; Tran et al., 2021; Wang et al., 2021). In addition, two studies included a group of healthy controls but did not perform a statistical comparison with the ASD group (Reynolds et al., 2012; Köse et al., 2017). However, both these studies reported similar rates of frequent nightmares between the two groups, ranging from 0 % to 2.1 % in ASD and 0–3.6 % in TD children (Reynolds et al., 2012; Köse et al., 2017).

In one study involving individuals with Asperger syndrome or high-functioning autism, the prevalence of nightmares was assessed by both parents and children. Parents reported a nightmare frequency of 13.7 % in the ASD group and 0 % in the TD group, while children with ASD self-reported a frequency of 57.4 %, compared to 37.3 % in the control group. This study did not perform a statistical comparison for parent-reported prevalence; however, it found no significant difference between the two groups in child self-reported nightmare frequency (Paavonen et al., 2008).

Similarly, another study comparing healthy controls and children with Asperger syndrome, 31 % of whom with insomnia symptoms, failed to find a significant difference in nightmare frequency reported by parents (Allik et al., 2006).

Consistent with these findings, several other studies found no significant differences in parent-reported nightmare prevalence between TD controls and children with ASD, regardless of their level of cognitive functioning, comorbidities and medication use (Chou et al., 2012; Tsai et al., 2012; Mutluer et al., 2016; Malhi et al., 2019; Kang et al., 2020; Bruni et al., 2021; Tran et al., 2021).

A study comparing nightmares between participants with ASD, their unaffected siblings, and TD peers found no difference in nightmare prevalence between ASD and TD groups. However, it was observed that unaffected siblings were at higher risk of experiencing nightmares than both children with ASD and TD children (Chou et al., 2012).

In contrast to this finding, some studies reported a higher prevalence of nightmares in the ASD group (Krakowiak et al., 2008; Mughal et al., 2021; Wang et al., 2021). In particular, girls with ASD experienced more nightmares than TD girls (16.6 % in females with ASD vs. 4.7 % in TD females), whereas no significant difference in nightmare frequency was found between boys with ASD and their TD peers (10.5 % in males with ASD vs. 5.6 % in TD males) (Wang et al., 2021).

To conclude, a study focusing on nightmare content, despite not comparing the two groups for the various oneiric themes, reported an overall higher nightmare frequency in participants with ASD compared to TD children (Mughal et al., 2021).

3.5. Comparing nightmare prevalence between autism and other mental disorders

Six studies included other clinical groups in addition to the ASD sample (Krakowiak et al., 2008; Tsai et al., 2012; Köse et al., 2017; Bruni et al., 2021; Guller et al., 2021; Mughal et al., 2021). Furthermore, a study using 14-day sleep diaries examined sleep characteristics comparing participants with ASD to a control group comprising children with and without comorbid ID. The authors reported a nightmare prevalence of 13 % in the ASD group and 11 % in the control group, without making statistical comparisons between the two groups (Patzold et al., 1998). Similarly, other studies focusing on children and adolescents with ID found similar prevalence of nightmares in both the ASD and ID groups although no statistical comparisons were performed (Köse et al., 2017; Guller et al., 2021). Conversely, a higher prevalence of nightmares was observed in the ASD group compared to both TD children and patients with developmental delays (Krakowiak et al., 2008).

A separate study examined the presence of sleep problems, as defined by DSM-IV diagnostic criteria, and described the prevalence of current and lifetime nightmares in children with ASD, epilepsy, and ADHD. The findings suggested that children with ASD compared to those with epilepsy may have a higher risk of experiencing current nightmares, but not lifetime nightmares, while no significant difference was found between the ASD and ADHD groups (Tsai et al., 2012). In contrast, another study assessing nightmare frequency in ASD and ADHD samples during the COVID-19 pandemic revealed a higher prevalence of nightmares in participants with ADHD both before (11.9 % in ADHD vs. 2.0 % in ASD) and after the lockdown (17.8 % in ADHD vs. 5.0 % in ASD) (Bruni et al., 2021). Finally, no difference was observed in nightmare frequency between children and adolescents with ASD and those with fetal alcohol syndrome (Mughal et al., 2021).

3.6. The relationship between nightmares, clinical symptoms, and cognitive functioning in children and adolescents with ASD

Seven research works explored the relationship between nightmares and clinical symptoms, and the association between nightmares and cognitive functioning (Gail Williams et al., 2004; Mayes and Calhoun, 2009; Nadeau et al., 2015; Reynolds et al., 2017; Calhoun et al., 2020; Mughal et al., 2021; Wang et al., 2021). One study described a positive correlation between nightmares and other items of the Pediatric Behavior Scale, which measures symptoms of sleep disturbance. In particular, significant correlations were reported with the presence of other parasomnias (e.g., sleep talking and sleepwalking), difficulties in falling asleep, night awakenings, reduced total sleep time, and restlessness during sleep (Mayes and Calhoun, 2009). Confirming these findings, other studies found an association between nightmares and sleep problems (Nadeau et al., 2015; Reynolds et al., 2017; Wang et al., 2021).

In addition, a study comparing nightmares between subgroups with and without sleep disturbances found that participants with ASD and comorbid sleep disturbances experienced significantly more nightmares (79.2 %) than those without sleep disturbances (16.7 %) (Calhoun et al., 2020).

The relationship between nightmares, clinical symptoms, and behavioral problems is less conclusive. While some studies found a positive correlation between nightmares, internalizing (Nadeau et al., 2015; Reynolds et al., 2017) or externalizing behaviors (Reynolds et al., 2017), and anxiety symptoms (Nadeau et al., 2015), others did not replicate these findings (Mughal et al., 2021; Wang et al., 2021). It is worth adding that the presence of nightmares was also related to the severity of autistic symptoms (Nadeau et al., 2015), aggressive behavior, and stress (Wang et al., 2021).

The association between nightmares and cognitive functioning remains similarly inconclusive. In fact, some evidence suggests a positive correlation between nightmares, executive functions (Reynolds et al., 2017) and IQ (Mayes and Calhoun, 2009; Reynolds et al., 2017), while other studies failed to replicate these results (Gail Williams et al., 2004; Mughal et al., 2021). A study found no significant difference in nightmare frequency comparing individuals with ASD and a comorbid ID to those without a comorbid ID (Gail Williams et al., 2004). Moreover, no significant associations were found between nightmares, executive functions (Mughal et al., 2021), and attention problems (Wang et al., 2021).

4. Discussion

4.1. Nightmares in children and adolescents with ASD

This review aimed to systematically examine the available evidence on the prevalence of nightmares in children and adolescents with ASD and to deepen understanding of possible associations with cognitive functioning and clinical symptoms. However, given the heterogeneous prevalence estimates across studies, the current findings do not permit an accurate estimation of the actual nightmare prevalence, nor provide conclusive insights into the relationship between nightmares and daytime functioning in children on the spectrum.

Several studies did not specify the frequency with which nightmares were assessed and described prevalence rates in children and adolescents with ASD, reaching up to 17.8 % (Patzold et al., 1998; Chou et al., 2012; Tsai et al., 2012; Nadeau et al., 2015; Mutluer et al., 2016; Guller et al., 2021; Sommers et al., 2024).

According to other studies, the prevalence of nightmares in ASD experienced “sometimes”, without a specified weekly frequency, ranged from 24.7 % to 33.3 % (Reynolds et al., 2012, 2017), while nightmares occurring “sometimes” or “2–4 times a week” were reported by 17–21 % of participants (Liu et al., 2006; Johnson et al., 2016).

Studies assessing the prevalence of nightmares experienced very frequently (Gail Williams et al., 2004; Allik et al., 2006; Liu et al., 2006; Krakowiak et al., 2008; Reynolds et al., 2012, 2017; Johnson et al., 2016; Köse et al., 2017; Malhi et al., 2019; Kang et al., 2020), or more than five times a week (Allik et al., 2006; Liu et al., 2006; Johnson et al., 2016; Köse et al., 2017; Kang et al., 2020), found rates below 5 %, while those examining the prevalence of frequent bad dreams, reported percentages of 19.2–31 % (Doo and Wing, 2006; Samanta et al., 2020).

Overall, the prevalence rates of nightmares in ASD discussed above appear to be lower than those reported in a recent systematic review (El Sabbagh et al., 2023), which found nightmare percentages ranging from 27 % to 57 % in the past week and from 18 % to 22 % in the past month in pediatric developmental clinical samples. In our review, relatively few studies reported estimates of 18 % or higher (Mayes and Calhoun, 2009; Reynolds et al., 2012, 2017; Johnson et al., 2016; Calhoun et al., 2020; Mughal et al., 2021), regardless of the time frame used to assess nightmares (e.g., past week or past month). Moreover, only a minority of studies observed a remarkable presence of nightmares in participants with ASD (33.3 %-47.9 %) (Mayes and Calhoun, 2009; Reynolds et al., 2012; Calhoun et al., 2020; Mughal et al., 2021), and a higher incidence in the ASD group compared to healthy controls (Krakowiak et al., 2008; Mughal et al., 2021; Wang et al., 2021).

When focusing on the comparison with nonclinical populations, it is worth noting that some of the reviewed studies found rates of weekly nightmares in individuals with ASD ranging from 13.7 % to 21.2 % (Liu et al., 2006; Paavonen et al., 2008; Johnson et al., 2016), which are higher than those reported in the literature for typically developing children (1–11 %) (El Sabbagh et al., 2023).

These findings are consistent with the continuity hypothesis (Hall, 1953; Bell and Hall, 1971) and with the existing literature on oneiric activity in patients with mental disorders which suggests an increased nightmare frequency in both children (Simonds and Parraga, 1984; Alfano et al., 2007; Hvolby et al., 2009; Chiang et al., 2010) and adults (Semiz et al., 2008; Lusignan et al., 2009; Schredl et al., 2012; Rimsh and

Table 2
Characteristics of the included studies that examined nightmare frequency or nightmare prevalence and the relationship between clinical symptoms and cognitive functioning. The studies are presented in alphabetical order of the first author.

First author and year	Sample size	Mean age (SD)/ range in years (or months if specified)	IQ	Nightmare questionnaire/ question	Time period assessed	Respondent	Nightmare prevalence/ frequency (%) ASD	TD	OCG	Nightmare prevalence/ frequency ASD vs. TD	Nightmare prevalence/ frequency ASD vs. OCG	Relationship between nightmares, clinical symptoms, and cognitive abilities in the ASD group
Allik et al., (2006)	ASD: N = 32 (4 F) n = 13 HFA n = 19 AS TD: N = 32 (4 F)	ASD: 10.8 8.5–12.8 TD: 10.9 8.5–13.4	ASD: Normal intelligence, IQ not shown TD: Not measured	Parental pediatric sleep questionnaire Item: "Child has nightmares"	Previous 6 months	Parent	Never: 15.6 Rarely: 78.1 ≥ 1–2 times a week: 3.1 ≥ 3 times a week: 0 ≥ 5 times a week: 3.1	Never: 31.3 Rarely: 62.5 ≥ 1–2 times a week: 3.1 ≥ 3 times a week: 3.1 ≥ 5 times a week: 0		ns		
Bruni et al., (2021)	ASD: N = 100 (16 F) ADHD: N = 236 (44 F) TD: N = 340 (58 F)	4–18		Modified version of the SDSC	Retrospective questions to evaluate perceived changes over two time periods: from "before the lockdown" (e.g., the last month before the outbreak) to "during the lockdown" (e.g., the 7 days immediately before completing the survey)	Parent	Before lockdown: 2.0 During lockdown: 5.0 Nightmares before lockdown vs. during lockdown: ns	Before lockdown: 4.7 During lockdown: 10.3 Nightmares during lockdown > before lockdown	Before lockdown: 11.9 During lockdown: 17.8 Nightmares before lockdown vs. during lockdown: ns	Before lockdown: ns During lockdown: ns	Before lockdown: ADHD > ASD During lockdown: ADHD > ASD	
Bruni et al., (2022)	ASD: N = 111 (18 F)	1–18 years 1–3 years: n = 11 (9.91 %) 4–5 years: n = 24 (21.62 %) 6–12 years: n = 47 (42.34 %) 13–18 years: n = 29 (26.13 %)		Modified version of the SDSC	Retrospective questions to evaluate perceived changes over two time periods: from "before the lockdown" (e.g., the last month before the outbreak) to "during the lockdown" (e.g., the 7 days immediately	Parent	Whole sample: Before lockdown: 1.8 During lockdown: 4.5 Nightmares before lockdown vs. during lockdown: ns 1–3 years: Before lockdown:					

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					before completing the survey)		0 During lockdown: 0 4–5 years: Before lockdown: 0 During lockdown: 0 6–12 years: Before lockdown: 4.3 During lockdown: 8.5 13–18 years: Before lockdown: 2.1 During lockdown: 3.4			
Calhoun et al., (2020)	ASD: N = 96 (18 F)	12.47 (1.57) 11–17	Mean IQ= 101.4 SD = 14.0	PBS Item: "Nightmares"	Previous 2 months	Parent	Whole sample, sometimes or more a problem: 47.9 Participants with ASD and sleep disturbances: 79.2 Participants with ASD without sleep disturbances: 16.7			Participants with ASD and sleep disturbances had significantly more nightmares than those without sleep disturbances
Chou et al., (2012)	ASD: N = 110 (14 F) TD: N = 110 (14 F) Unaffected sibling: N = 125 (50 F)	ASD: 7.6 (2.4) 5–13 TD: 7.9 (2.0) 5–13 Unaffected sibling: 6.9 (3.2) 4–13		Revised version of the SHQ with operational definitions of each sleep problem aligned with the DSM-IV criteria for sleep disorders	Previous 6 months	Parent	11.0	TD: 10.9 Unaffected sibling: 24.8	Unaffected siblings had a higher risk of nightmares than children with ASD OR= 0.38 (0.18–0.81) and TD children OR= 2.66 (1.24–5.71) ASD vs. TD: ns	
Doo and Wing, (2006)	ASD: N = 193 (25 F) n = 94 AD	3.6 (1.4) 2–7.7	61 children had an IQ/DQ > 85, 71 children	CSHQ	Recent "typical" week	Parent	Scary dreams (more than twice a week): 19.2			

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	n = 99 PDD-NOS/AS		had an IQ/DQ between 70 and 85, and 61 children had an IQ/DQ < 70							
Gail Williams et al., (2004)	ASD: N = 210 (32 F)	8.4 2–16	127 participants had an IQ < 70	Questionnaire adapted from Gozal (1998)	Parent	Frequently or almost always: 3.8				No significant difference in nightmare frequency between participants with IQ < 70 and ≥ 70
Guller et al., (2021)	ASD: N = 131 (20 F) ID: N = 103 (42 F) SLD: N = 46 (21 F) CD: N = 19 (3 F)	ASD: 10.31 (4.32) ID: 9.85 (5.36) SLD: 11.21 (2.85) CD: 10.89 (5.07)		Questionnaire developed by the authors	Parent	0.8		ID: 1.0 SLD: 6.5 CD: 0.0		
Johnson et al., (2016)	ASD: N = 310 (45 F)	2–10	185 children had an IQ ≥ 70, while 97 children had an IQ < 70	CSHQ Item: "Child awakens alarmed by a frightening dream"	Parent	Rarely (0–1 nights per week): 76.8 Sometimes (2–4 nights per week): 21.2 Usually (5–7 nights per week): 1.5				
Kang et al., (2020)	ASD: N = 252 (49 F) TD: N = 223 (56 F)	ASD: 5.13 (1.15) 3–6 TD: 5.12 (0.97) 3–6		CSHQ Item: "Awakes with nightmare"	Parent	Usually (5–7 nights per week): 0.4	Usually (5–7 nights per week): 1.8		Usually (5–7 nights per week): ns	
Katz et al., (2018)	Training: ASD N = 1437 (227 F) n = 950 AD n = 154 AS n = 293 PDD-NOS Validation: ASD N = 1435 (227 F) n = 962 AD	Training: 6.6 (1.9) 4–10 Validation: 6.6 (1.9) 4–10		CSHQ Item: "Awakes alarmed by a frightening dream"	Parent	Rarely Training: 78.08 Validation: 79.86				

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	n = 121 AS n = 305 PDD-NOS										
Köse et al., (2017)	ASD: N = 48 (8 F) TD: N = 48 (25 F) ID: N = 46 (20 F)	ASD: 11.17 (3.07) 10.28–12.06 TD: 10.7 (4.40) 9.47–12.02 ID: 13.0 (3.05) 12.11–13.92	22.9 % of children with ASD had mild, 18.8 % had moderate and 14.6 % had severe intellectual disability. Total ID prevalence was 56.3 %. 63.4 % of children with ID had mild, 29.3 % had moderate and 7.3 % had severe ID	CSHQ Item: "Awakening alarmed by a frightening dream"	Past month	The questionnaire was filled out by an author through interviewing the child's parent	Usually (5–7 nights per week): 2.1	Usually (5–7 nights per week): 0	Usually (5–7 nights per week): 2.2		
Krakowiak et al., (2008)	ASD: N = 303 (36 F) DD: N = 63 (17 F) TD: N = 163 (29 F)	3.6 (0.8) 2–5	ASD: 13.2 % of children had a normal IQ TD: 100 % of children had a normal IQ DD: 0 % of children had a normal IQ	CHARGE Sleep History which contains items similar to those of the CSHQ Item: "Has nightmares"		Parent	Frequently: 4.3	Frequently: 0.6	Frequently: 1.6	Frequently: ASD > TD and DD	Frequently: ASD > TD and DD
Liu et al., (2006)	ASD: N = 167 (23 F) n = 108 AD n = 27 AS n = 32 two diagnoses or other diagnoses of ASD (e.g., PDD, PDD-NOS, HFA)	8.8 (4.0) 2.4–18.2		Modified version of the CSHQ Item: "Awaken alarmed by a frightening dream"	Previous month	Parent	Sometimes (2–4 times per week): 17.4 Usually (5–7 times per week): 4.2				
Malhi et al., (2019)	ASD: N = 60 (9 F) TD: N = 60 (30 F)	ASD: 6.10 (2.40) TD: 6.46 (2.10)	28.6 % of children with ASD had a severe cognitive impairment, 33.9 % a mild/ borderline cognitive impairment and 16.1 %	CSHQ Item: "Awakens by fearful dream"	Typical and most recent week	Parent	Usually: 5.0	Usually: 1.7		Usually: ns	

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			had normal ability								
Mayes and Calhoun, (2009)	ASD: N = 477 (62 F)	6.5 (3.0) 1–15	Mean IQ = 85.4 SD = 27.8 Range: 9–146	PBS Item: "Nightmares"	Parent	From sometimes to very often a problem: 39 No significant correlation between nightmares and age					Positive correlation between nightmare and IQ Nightmares were positively correlated with difficulty falling asleep, restlessness during sleep, sleep talking or sleepwalking, night awakenings, early awakenings and reduced sleep duration Nightmares were significantly less of a problem than the other sleep items
Mughal et al., (2021)	ASD: N = 61 (15 F) FASD: N = 112 (50 F) TD: N = 104 (48 F)	ASD: 10.03 (2.54) 6.07–15.56 FASD: 9.54 (2.86) 6.09–15.98 TD: 9.43 (2.55) 6.47–15.90		CSHQ Item: "Does your child have nightmares? If so, describe the frequency and content"	Parent	40.3 Nightmare content reported by parents Being chased: 7 Injured/ Dying: 11 Sensing scary: 4 Thematic analysis: Separation (22 %), fantasy (22 %), persecuted being chased (11 %), real life (22 %), death injury violence (22 %), robbery theft crime (0 %)	21.4 Nightmare content reported by parents Being chased: 5 Injured/ Dying: 9 Sensing scary: 0 Thematic analysis: Separation (23 %), fantasy (23 %), persecuted being chased (15 %), real life (23 %), death injury violence (15 %), robbery theft crime (0 %)	73.6 Nightmare content reported by parents Being chased: 15 Injured/ Dying: 6 Sensing scary: 1 Thematic analysis: Separation (24 %), fantasy (30 %), persecuted being chased (22 %), real life (9 %), death injury violence (24 %), robbery	From "less than monthly to nightly" ASD > TD	From "less than monthly to nightly" ns	No correlations between nightmare frequency, CBCL, BRIEF, and SCAS scores

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									theft crime (9 %)		
Mutluer et al., (2016)	ASD: N = 64 TD: N = 53 (13 F)	ASD: 11.66 (3.8) TD: 11.75 (0.85)		Extended version of the PSQ		Parent	9.4	13.2		ns	
Nadeau et al., (2015)	ASD-anxiety disorder: N = 102 (21 F) n = 42 AS n = 30 AD n = 30 PDD-NOS n = 40 completed CBT	10.81 (2.31) 7–16		CBCL Item: "Has nightmares"	Previous 6 months	Parent	17.8 Nightmares in females with ASD > males with ASD Pre-CBT: 34.8 Post-CBT: 12.8 Nightmares pre-CBT > nightmares post-CBT				Positive correlation between nightmares and sleep related problems, ASD symptoms, parent-rated anxiety, internalizing behaviors, and clinician-rated anxiety No correlation between nightmares and externalizing behaviors
Paavonen et al., (2008)	AS: N = 52 (12 F) TD: N = 61 (32 F)	AS: 10.1 (3.4) 4.8–17.0 TD: 10.0 (1.9) 76.9–13.1	IQ was measured for 41 children with ASD Total IQ: Mean = 94.2 SD = 15.2 Verbal IQ: Mean = 91.8 SD = 15.4 Non-verbal IQ: Mean = 98.2 SD = 17.2	SDSC Item: "Has nightmares which he/she does not remember the next day" SSR Item: "Do you have nightmares?"		Parent Child	Parent-report (at least once a week): 13.7 Self-report (occasional nightmares): 57.4	Parent-report (at least once a week): 0 Self-report (occasional nightmares): 37.3		Self-report: (occasional nightmares): ns	
Patzold et al., (1998)	ASD: N = 38 (7 F) n = 31 AD n = 7 AS CG: N = 36 (7 F)	ASD: 93.5 (31.5) 44–152 months CG: 101.2 (31.0) 63–171 months	17 children with ASD and 13 CG children had an IQ ≤ 55, 21 children with ASD and 23 CG children had an IQ > 55	Sleep diary	14-day diary period	Parent	13		11		
Reynolds et al., (2012)	ASD: N = 27 (4 F) TD: N = 28 (14 F)	ASD: 104.9 (21.9) months 6–12 years TD: 105.0 (22.9) months 6–12 years	ASD: Mean IQ= 95.88 SD = 17.8 TD: Mean IQ= 112.36 SD = 12.8	CBCL		Parent	Not true: 65.4 Sometimes: 33.3 Very true: 0	Not true: 60.7 Sometimes: 25 Very true: 3.6			

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Reynolds et al., (2017)	ASD-ADHD: N = 85 (21 F)	9.29 (1.79) 6.66–12.91	Verbal IQ: Mean = 80.71 SD = 21.88 Non-verbal IQ: Mean = 85.69 SD = 18.62	CBCL		Parent	Not true: 70.6 Sometimes true: 24.7 Always true: 4.7					Positive correlation between nightmares and nonverbal IQ, BRIEF-MI score, total problematic sleep behavior, reduced sleep duration, externalizing and internalizing behaviors (CBCL)
Samanta et al., (2020)	ASD: N = 100 (0 F)	4.33 (1.09) 2–6		CSHQ Item: "Alarmed by frightening dream"	Previous week or the most recent typical week in case the last week was unusual for a specific reason	Parent	Rarely: 39 Sometimes: 30 Usually: 31					
Sommers et al., (2024)	ASD: N = 240 (85 F)	8.80 (2.12) 5–13		Modified version of the CSHQ		Parent	5					
Tran et al., (2021)	ASD: N = 37 (6 F) TD: N = 40 (20 F)	ASD: 9.0 (3.9) 3–17 TD: 4.5 (0.9) 3–17		Telephone survey Item: "Did your child complain of bad dreams?"	8 and 24 hours after leaving the surgery clinic	Parent	8 hours after leaving the surgery clinic: 5.4 24 hours after leaving the surgery clinic: 5.4	8 hours after leaving the surgery clinic: 2.5 24 hours after leaving the surgery clinic: 0.0		8 hours after leaving the surgery clinic: ns 24 hours after leaving the surgery clinic: ns		
Tsai et al., (2012)	ASD: N = 64 (25 F) ADHD: N = 64 (25 F) Epilepsy: N = 64 (25 F) TD: N = 64 (25 F)	ASD: 10.08 (2.73) 6–17 ADHD: 9.89 (2.57) 6–16 Epilepsy: 9.83 (2.61) 6–16 TD: 9.91 (2.43) 6–16	Full-Scale IQ > 80	Modified version of the SHQ using the operational definitions for each sleep problem in accordance with the relevant DSM-IV sleep disorders	Current (past six months) and lifetime	Parent	Current: 17.5 Lifetime: 25	Current: 21.9	Current: ADHD 10.9 Epilepsy 4.7 Lifetime: ADHD 26.6 Epilepsy 16	Current: ns	Current: Children with ASD had a higher risk of nightmares than children in the epilepsy group OR= 4.3 (1.14–16.25) ASD vs. ADHD ns Lifetime: ASD vs. ADHD ns ASD vs. epilepsy ns	
Wang et al., (2021)	ASD: N = 474 (72 F) TD:	ASD: 3.73 (1.01) 2–5 TD:		CSHQ	Sleep problems assessed within a week	Parent	Sometimes or usually: Male: 10.5 Female:	Sometimes or usually: Male: 5.6 Female:		Sometimes or usually: Males with ASD vs. TD males:		Positive correlations between nightmares and emotionally

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	N = 193 (86 F)	3.71 (0.86) 2–5			16.6 Females with ASD vs. males with ASD: ns	4.7 TD females vs. TD males: ns	ns Females with ASD > TD females	reactive problems, sleep problems, aggressive behavior, and stress No correlations between nightmares and internalizing, externalizing, and total problems, anxiety/ depression, somatic complaints, withdrawn and attention problems
Wiggs and Stores, (2004)	ASD: N = 69 (14 F) n = 40 AD n = 18 diagnosed on the autistic spectrum n = 11 AS	9.4 (2.7) 5–16	Simonds and Parraga Sleep Questionnaire administered verbally	Parent	Unsure: 4.35 Infrequent: 92.75 1–2 per week: 1.45 3 + per week: 1.45			

Abbreviations: AD, autistic disorder; ADHD-C, ADHD-combined type; ADHD-I, ADHD-inattentive type; ADHD, Attention Deficit Hyperactivity Disorders; AS, Asperger Syndrome; ASD, Autism Spectrum Disorders; BRIEF-MI, BRIEF Metacognition Index; BRIEF, Behavior Rating Inventory for Executive Functioning; CBCL, Child Behavior Checklist; CBT, Cognitive-Behavior Therapy; CD, Communication Disorders; CG, control group; CHARGE, Childhood Autism Risks from Genetics and the Environment; CSHQ, Children's Sleep Habits Questionnaire; DD, Development Delays; DQ, Developmental Quotient; DSM-IV, Diagnostic and Statistical Manual of mental disorders fourth edition; FASD, Fetal Alcohol Spectrum Disorders; HFA, high-functioning autism; ID, Intellectual Disability; IQ, Intellectual Quotient; ns, non-significant; OCG, other clinical groups; OR, Odds Ratio; PBS, Pediatric Behavior Scale; PDD-NOS, Pervasive Developmental Disorder not otherwise specified; PDD, Pervasive Developmental Disorder; PSQ, Pediatric Sleep Questionnaire; SCAS, Spence Children's Anxiety Scale; SD, Standard Deviation; SDSC, Sleep Disturbance Scale for Children; SHQ, Sleep Habit Questionnaire; SLD, Specific Learning Disorder; SSR, Sleep Self-Report; TD, typically developing group.

Pietrowsky, 2022).

It should be considered that the limited number of studies reporting a high prevalence of nightmares in children with ASD often included participants with comorbid conditions (Calhoun et al., 2020; Mughal et al., 2021), such as sleep disorders (Calhoun et al., 2020), and a notable proportion of individuals taking medication (Mayes and Calhoun, 2009; Calhoun et al., 2020), including stimulants, mood stabilizers, and neuroleptics (Mayes and Calhoun, 2009). Empirical evidence suggests that pharmacological treatments may influence dream activity (for review, see Nicolas and Ruby, 2020). Several studies highlighted an increased frequency of dream recall and nightmares following the administration of neuroleptics and antidepressants (Flemenbaum, 1976; Strayhorn and Nash, 1978; Lepkifker et al., 1995; Coupland et al., 1996; Quartini et al., 2014).

However, the evidence on dream quality after treatment with selective serotonin reuptake inhibitors (SSRIs) remained somewhat inconsistent. For instance, fluoxetine increased dream and nightmare recall (Armitage et al., 1995; Lepkifker et al., 1995). In contrast, paroxetine and fluvoxamine appeared to reduce the frequency of dream recall, while enhancing the intensity of the oneiric experience (e.g., memorability, vividness, amount of sound, emotionality, and meaningfulness) (Pace-Schott et al., 2001).

Research also explored the effects of dopaminergic drugs on dream activity. In particular, drugs that facilitate dopaminergic release seemed to increase the frequency of the oneiric recall (Sharf et al., 1978; Polini et al., 2017), whereas dopamine antagonists, or the hypodopaminergic state, qualitatively impoverished dream reports (Gaillard and Moneme, 1977; De Gennaro et al., 2016).

Nevertheless, the impact of medication on nightmares in ASD has not yet been systematically investigated. It is worth mentioning that other studies, that involved many participants with ASD taking medication, did not replicate such high prevalence rates (Patzold et al., 1998; Wiggs and Stores, 2004; Liu et al., 2006; Krakowiak et al., 2008; Tsai et al., 2012; Nadeau et al., 2015; Köse et al., 2017; Sommers et al., 2024), and research attempting to investigate the impact of medication only focused on sleep disorders, without assessing nightmares (Mayes and Calhoun, 2009).

Apart from the influence that drug therapies may have on dreaming, suffering from anxiety and depressive symptoms may enhance the likelihood of experiencing bad dreams and nightmares in children, adolescents (Nielsen et al., 2000; Secrist et al., 2019; Wang et al., 2023) and adults (Nguyen et al., 2002; Blagrove et al., 2004; Eller et al., 2006).

To this point, some research works found an association between nightmares in ASD and internalizing (Nadeau et al., 2015; Reynolds et al., 2017) or externalizing behavior (Reynolds et al., 2017), and anxiety symptoms (Nadeau et al., 2015), but others failed to replicate these findings (Mughal et al., 2021; Wang et al., 2021). However, the only study that found a relationship between nightmares and anxiety symptoms was carried out on children with ASD and comorbid anxiety disorders (Nadeau et al., 2015), suggesting that anxiety may represent a contributing factor to the occurrence of nightmares in this clinical population.

Although it remains unclear whether the abovementioned comorbidities directly influence nightmares in ASD since the evidence on this issue remains conflicting, sleep problems and insomnia may play an important role in the occurrence of nightmares.

Sleep disorders, especially insomnia, are remarkably common in children and adolescents with ASD, with prevalence estimates ranging from 32 % to 71.5 % (Bruni et al., 2024). Despite the scarcity of the available literature, there is consistent evidence pointing to an association between disrupted sleep patterns and increased nightmares in ASD (Mayes and Calhoun, 2009; Nadeau et al., 2015; Reynolds et al., 2017; Calhoun et al., 2020; Wang et al., 2021). These findings are in line with the activation hypothesis (Koulack and Goodenough, 1976; Hobson and McCarley, 1977; Antrobus, 1991), a widely supported theory of dreaming, which posits that lighter sleep and higher levels of arousal during sleep increase the chances of recalling dreams (Scarpelli et al., 2017, 2020a, 2020b; Siclari et al., 2017).

On the other hand, it is equally plausible that many children on the spectrum do not report this type of dream alteration. Several hypotheses can be drawn on this argument. For instance, nightmares are a REM sleep parasomnia, and a meta-analysis found a shorter REM sleep duration in youths with ASD compared to controls (Díaz-Román et al., 2018). Further, nightmares are more frequently reported by women than men (Schredl and Reinhard, 2011), and the female gender is underrepresented in the population with ASD (Loomes et al., 2017). As a result, this type of dream activity may be less common among individuals with autism.

In addition, the limited research on dreaming suggests that children with ASD tend to begin discussing their dreams much later than their typically developing peers (Craig et al., 1998). This delay could be attributed to difficulties in distinguishing between different mental states (Baron-Cohen, 1989), which may lead to misinterpretation of the actual meaning of dreaming. Furthermore, the ability to recall a dream experience is contingent upon the development of introspective skills and the ability to understand and interpret one's own emotional experiences. In children with autism, difficulties in processing such information, or a reduced interest in doing so, may contribute to a lower frequency of dream recall (Daoust et al., 2008).

It is worth adding that a significant proportion of this population exhibits more severe autistic symptoms and lacks verbal communication (Rose et al., 2016). Consequently, many individuals with ASD may be unable to report their nightmares, complicating efforts to assess nightmare prevalence across the entire spectrum.

Finally, a substantial body of research suggests that nightmares relate to both state factors, as they may be reactive to stressful events (Wood et al., 1992; Nielsen et al., 2006; Sandman et al., 2013; Scarpelli et al., 2022b), and trait-based dispositions associated with emotional distress (Zadra and Donderi, 2000; Pietrowsky and Köthe, 2003; Schredl, 2003; Schredl and Göritz, 2021; Gratton et al., 2024). In the case of autism, trait-based vulnerabilities, such as elevated levels of neuroticism (Lodi-Smith et al., 2019) and anxiety (Jolliffe et al., 2023), are indeed present. However, individuals with ASD often lead highly structured and routine lives, with limited exposure to unpredictable stressors and emotional fluctuations (Rodgers et al., 2012; Vasa et al., 2018; Petrolini et al., 2023). As a result, the situational events that typically trigger nightmares may be less common and have little impact on nightmare frequency in this clinical population. Nevertheless, these considerations remain largely speculative, as the literature on dreaming in ASD has yet to explore the relationship between nightmares and situational or dispositional factors.

In line with this theoretical framework, most studies included in our review found no significant difference in the occurrence of nightmares between participants with ASD and their typically developing peers (Allik et al., 2006; Paavonen et al., 2008; Chou et al., 2012; Tsai et al., 2012; Mutluer et al., 2016; Malhi et al., 2019; Kang et al., 2020; Bruni et al., 2021; Tran et al., 2021). Quite surprisingly, it was observed that unaffected siblings may be at higher risk of experiencing nightmares compared to children with ASD. One possible explanation concerns their greater vulnerability to suffering from anxiety symptoms (Chou et al., 2012).

Nightmares are a prominent sleep feature during puberty, a critical period for neural and psychological maturation (Kirov and Brand, 2011). The frequent occurrence of nightmares at this phase of life (El Sabbagh et al., 2023) may be a natural consequence of the significant changes occurring before adulthood and the maturation of REM sleep when nightmares typically occur.

Indeed, while dreaming is believed to serve a fear-extinction function, the occurrence of nightmares may indicate a breakdown in this process and a failure in emotional regulation (Levin and Nielsen, 2009). In this vein, childhood nightmares may originate from an unfruitful attempt to cope with and process adverse experiences, stemming from a

still underdeveloped ability to manage the emotional distress caused by unpleasant life events (Scarpelli et al., 2019).

These challenges are even more pronounced in children and adolescents with mental disorders, who are more prone to suffer from nightmares than their unaffected peers (Simonds and Parraga, 1984; Alfano et al., 2007; Hvolby et al., 2009; Chiang et al., 2010). However, it remains unclear to what extent nightmares can represent a distinguishing feature within each mental disorder.

Only few studies included in this systematic review compared the prevalence of nightmares between different disorders, including autism. The results suggested that children with ASD would have more nightmares than those with developmental delays (Krakowiak et al., 2008) and epilepsy (Tsai et al., 2012). However, no difference was found when comparing them to patients with fetal alcohol syndrome (Mughal et al., 2021). Furthermore, one study reported a higher nightmare frequency in individuals with ADHD than in those with ASD (Bruni et al., 2021), though another paper failed to replicate this finding (Tsai et al., 2012).

Considering the varying clinical groups included, the definition of a unified theoretical framework remains challenging. A systematic empirical assessment is therefore needed to determine whether, and to what degree, nightmares in children with ASD are eventually comparable to those experienced by children with other mental disorders.

The variability of findings regarding nightmares in ASD may also be driven by the heterogeneity of children and adolescents who fall within this diagnostic category, as different cognitive deficits and symptomatic manifestations have been observed in this population (Lam et al., 2008; Kim et al., 2016; Zheng et al., 2019).

The hypothesis of a continuum between cognitive/neurobiological functioning and oneiric activity was addressed by several studies conducted on healthy children. This body of research suggests that the development of waking cognitive processes may reflect the maturation of dream content and the ability to recall dreams (see Mangiaruga et al., 2018; Scarpelli et al., 2021, 2022a for reviews). Nightmare frequency was also linked to cognitive abilities, particularly working memory, planning, and shifting (Mughal et al., 2021). However, these findings have not been consistently replicated in ASD, as only few studies reported an association with IQ (Mayes and Calhoun, 2009; Reynolds et al., 2017) and executive functions (Reynolds et al., 2017).

Overall, there is a clear need for further research to ascertain the potential relationship between oneiric activity and daytime functioning in children with ASD. It would be equally valuable to obtain a more accurate estimate of nightmare frequency and factors influencing their occurrence in this clinical population.

4.2. Methodological considerations

A substantial body of research examined nightmare prevalence in children and adolescents with ASD, while relatively few studies explored the relationship between nightmares and daytime functioning. The results of these studies presented a somewhat inconsistent picture, largely due to the differing methodologies employed, including: 1) variations in samples size, 2) inclusion of participants with different levels of cognitive functioning, 3) wide age ranges, 4) presence of psychiatric comorbidities and/or pharmacological treatment in certain clinical groups (Patzold et al., 1998; Wiggs and Stores, 2004; Allik et al., 2006; Liu et al., 2006; Krakowiak et al., 2008; Mayes and Calhoun, 2009; Tsai et al., 2012; Nadeau et al., 2015; Johnson et al., 2016; Köse et al., 2017; Reynolds et al., 2017; Katz et al., 2018; Calhoun et al., 2020; Mughal et al., 2021; Tran et al., 2021; Sommers et al., 2024), and 5) no assessment of comorbidities and/or medication use in other research works (Patzold et al., 1998; Gail Williams et al., 2004; Doo and Wing, 2006; Paavonen et al., 2008; Mayes and Calhoun, 2009; Chou et al., 2012; Reynolds et al., 2012, 2017; Katz et al., 2018; Calhoun et al., 2020; Bruni et al., 2021, 2022; Guller et al., 2021; Mughal et al., 2021; Wang et al., 2021).

Although several studies compared nightmare prevalence between children with ASD and their typically developing peers (Allik et al., 2006; Krakowiak et al., 2008; Paavonen et al., 2008; Chou et al., 2012; Reynolds et al., 2012; Tsai et al., 2012; Mutluer et al., 2016; Köse et al., 2017; Malhi et al., 2019; Kang et al., 2020; Bruni et al., 2021; Mughal et al., 2021; Tran et al., 2021; Wang et al., 2021), fewer papers examined the prevalence of nightmares in individuals with ASD compared to other clinical groups (Krakowiak et al., 2008; Tsai et al., 2012; Köse et al., 2017; Bruni et al., 2021; Guller et al., 2021; Mughal et al., 2021). This paucity of comparisons makes it difficult to draw definitive conclusions regarding how closely the prevalence of nightmares in individuals with ASD aligns with that observed in other clinical populations.

Certain issues have received limited attention, and others remain entirely unexplored. First, despite a considerable proportion of participants with ASD having psychiatric comorbidities and taking medication, the impact of these variables on dream activity was largely overlooked. Indeed, only a small number of studies examined the association between nightmares and comorbid symptoms (Mayes and Calhoun, 2009; Nadeau et al., 2015; Reynolds et al., 2017; Calhoun et al., 2020; Mughal et al., 2021; Wang et al., 2021), and no research work has so far investigated the relationship between nightmares and pharmacological treatment.

According to the literature on dreaming in typically developing children both gender and age may influence nightmares, with female gender and pubertal age being related to a higher prevalence of nightmares (El Sabbagh et al., 2023).

Unfortunately, few studies addressed sexual dimorphism in the occurrence of nightmares in ASD, yielding inconsistent results (Nadeau et al., 2015; Wang et al., 2021). However, the male-to-female ratio of approximately 3:1 (Loomes et al., 2017), may help to explain the limited interest in investigating the potential impact of the female gender on nightmare frequency in autism.

The inclusion of participants with ASD spanning a wide age range further prevents identifying nightmare prevalence at different stages of development. Thus far, only one study systematically investigated the frequency of nightmares within specific age categories (Bruni et al., 2022), replicating findings observed in typically developing children, pointing to school age and early adolescence as the periods with the highest incidence of nightmares (Schredl et al., 2009b; El Sabbagh et al., 2023). It is worth noting that another study included in this review, which described a nightmare prevalence of 39 % in the ASD sample, failed to find a significant correlation between age and nightmares (Mayes and Calhoun, 2009).

4.3. The definition of nightmares: theoretical remarks and open issues

Other methodological differences across studies may also have contributed to the variability in prevalence estimates. Firstly, some research works did not clearly define nightmares, which might have led to varying interpretations by researchers and participants. Indeed, only a few studies detailed how nightmares were operationalized, indicating whether the definition used encompassed subsequent awakenings following the dream experience (Liu et al., 2006; Johnson et al., 2016; Köse et al., 2017; Katz et al., 2018; Malhi et al., 2019; Kang et al., 2020). In addition, several studies did not mention the temporal frequency considered for prevalence estimates (Patzold et al., 1998; Chou et al., 2012; Tsai et al., 2012; Nadeau et al., 2015; Mutluer et al., 2016; Guller et al., 2021; Mughal et al., 2021; Sommers et al., 2024), nor did they clarify the recall period (Gail Williams et al., 2004; Wiggs and Stores, 2004; Krakowiak et al., 2008; Paavonen et al., 2008; Mayes and Calhoun, 2009; Reynolds et al., 2012, 2017; Johnson et al., 2016; Mutluer et al., 2016; Katz et al., 2018; Kang et al., 2020; Guller et al., 2021; Mughal et al., 2021; Sommers et al., 2024).

In all studies included in this review, nightmares were assessed by parents. A fairly large body of empirical evidence shows little agreement between caregiver-reported and child-self-reported nightmare frequency (Lapouse and Monk, 1958; Paavonen et al., 2000; Mindell and

Barrett, 2002; Schredl et al., 2009a; Grant et al., 2020). In general, parents tend to underestimate the presence of nightmares in their children (Mindell and Barrett, 2002; Schredl et al., 2009a; Grant et al., 2020). Consistently, the only study in this systematic review that assessed nightmares based on child self-reports found a notably high percentage of nightmares (57.4 %) (Paavonen et al., 2008), exceeding the parent-reported estimates in the other reviewed studies (Allik et al., 2006; Krakowiak et al., 2008; Nadeau et al., 2015; Mughal et al., 2021), which used the same question to assess nightmares as Paavonen et al. (2008) did for children's self-reports.

The heterogeneity of the instruments employed hindered the comparison and synthesis of study results. Indeed, dream-related variables were assessed using both standardized questionnaires and custom-developed tools (Gail Williams et al., 2004; Guller et al., 2021), with retrospective or prospective methods (e.g. sleep diaries) (Patzold et al., 1998) and different response formats.

An important source of variability and potential bias when studying nightmares is the lack of consensus regarding the definition of this type of dream activity and that of other phenomena (see Table 1). In this regard, the debate concerning whether dysphoric dreams must be followed by an awakening to be classified as nightmares is still ongoing (Robert and Zadra, 2014; Gieselmann et al., 2019). Whereas the DSM-IV (American Psychiatric Association, 1994) required repeated awakenings from sleep with a detailed recall of long and extremely dysphoric dreams, the DSM-5 no longer considers post-nightmare awakenings to be a necessary criterion for diagnosing a nightmare disorder (American Psychiatric Association, 2013). This change blurs the boundary between nightmares and bad dreams. The latter are highly distressing dreams that, although unpleasant, do not result in awakenings (Robert and Zadra, 2008). In this respect, Levin and Nielsen (2007, p. 484) conceptualized nightmares and bad dreams within the same theoretical framework, because "it remains unknown whether they are two qualitatively distinct phenomena or a single phenomenon that simply varies in intensity".

It is worth adding that it is not unusual for nightmares to be mistaken for sleep terrors, particularly in the retrospective data (Laberge et al., 2000). Sleep terrors are a common NREM sleep parasomnia in children aged between 1.5 and 13 years (56.2 %) and resolve by puberty (Petit et al., 2015). It should be noted that the definition of nightmares used in one of the included studies (Paavonen et al., 2008) (e.g., "has nightmares which he/she does not remember the next day?") may be open to misinterpretation. In fact, while nightmares are intensely vivid and well-remembered oneiric experiences, sleep terrors are typically followed by little or no recall of the event (American Psychiatric Association, 2013).

Taking into account the numerous methodological and theoretical differences in the terminology, definition, and assessment of nightmares, this review explicitly detailed the criteria used to operationalize them—where reported by the studies—including the tools employed, the frequency and recall period, as well as the prevalence of bad dreams (see Table 2).

5. Limitations

Our review has some limitations, many of which stem from the methodological weaknesses of the included studies. First, most studies assessed nightmares as part of a broader evaluation of sleep patterns without a specific focus on this oneiric phenomenon. Consequently, many research works lacked detailed information about the tools and definitions used to measure this type of dream activity. This flaw in study quality may therefore affect the overall variability of the results.

Secondly, this review was narrowly focused on studies conducted on children and adolescents diagnosed with autism. Since autism was formally recognized as a distinct clinical diagnosis only in 1980 with the DSM-III (American Psychiatric Association, 1980), earlier studies were not included in the analysis. As a result, our review may provide only a partial picture of the prevalence of nightmares within this clinical population. Moreover, the exclusion of studies focused on children and adolescents with autistic traits but lacking a formal diagnosis further limits the ability to provide an in-depth understanding of how autistic manifestations may influence nightmare frequency.

To conclude, a meta-analysis could not be performed due to the methodological variability of the studies. Indeed, the heterogeneity of the recruited samples and inconsistencies in the way nightmares were measured made it difficult to compare study results. For all these reasons, the findings discussed in this work should be interpreted with caution.

6. Conclusion and future directions

The current literature on nightmares in children and adolescents with ASD is still in its infancy.

Through this systematic review, we sought to advance understanding by synthesizing and critically discussing the existing findings. Overall, the available evidence suggests that the occurrence of nightmares in ASD may be better explained by comorbid clinical symptoms, particularly sleep disorders. However, despite the high prevalence of insomnia-related symptoms (Sivertsen et al., 2021; Al Lihabi, 2023) which typically contribute to increased dream recall (Delage et al., 2024), nightmares may not be a core feature of this neurodevelopmental disorder. It is worth noting that the study of dreams and nightmares relies on self-reporting. Thus, even if children with autism do experience nightmares, inherent features of the disorder—such as communication deficits, limited introspective ability, and difficulty recognizing their own emotions—may prevent them from recognizing and talking about their dreams.

Nevertheless, the current literature on dreaming in ASD does not yet provide sufficient evidence to confirm this hypothesis, and further research is needed. In particular, future studies should: 1) implement standardized protocols for the collection of dream reports, also using prospective methods (e.g., daily audio recordings and sleep diaries); 2) investigate factors that may influence dream activity, including comorbid psychological and medical conditions, history of previous traumatic experiences, and socio-demographic characteristics; 3) compare dream activity across different subgroups of individuals with ASD, such as those with and without sleep disorders; 4) examine the frequency of nightmares before and after treatment interventions, as suggested by the only pre-post study discussed in this review (Nadeau et al., 2015), which reported a significant decrease in nightmare frequency following CBT treatment; 5) conduct longitudinal studies to test whether nightmare frequency varies over time and whether nightmares can predict future symptomatic manifestations, and 6) test the wake-dream continuity hypothesis by comparing dream reports and nightmare content among children with ASD with different levels of cognitive functioning. In addition, objective measures (e.g., polysomnography, actigraphy) should be integrated with dream data collection in order to investigate potential associations between sleep characteristics and the frequency or content of nightmares.

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Declaration of Competing Interest

The authors have no conflicts of interest to declare.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.neubiorev.2025.106012.

Data availability

Study protocol is published on PROSPERO (ID: CRD42024513497).

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