

BACKGROUND

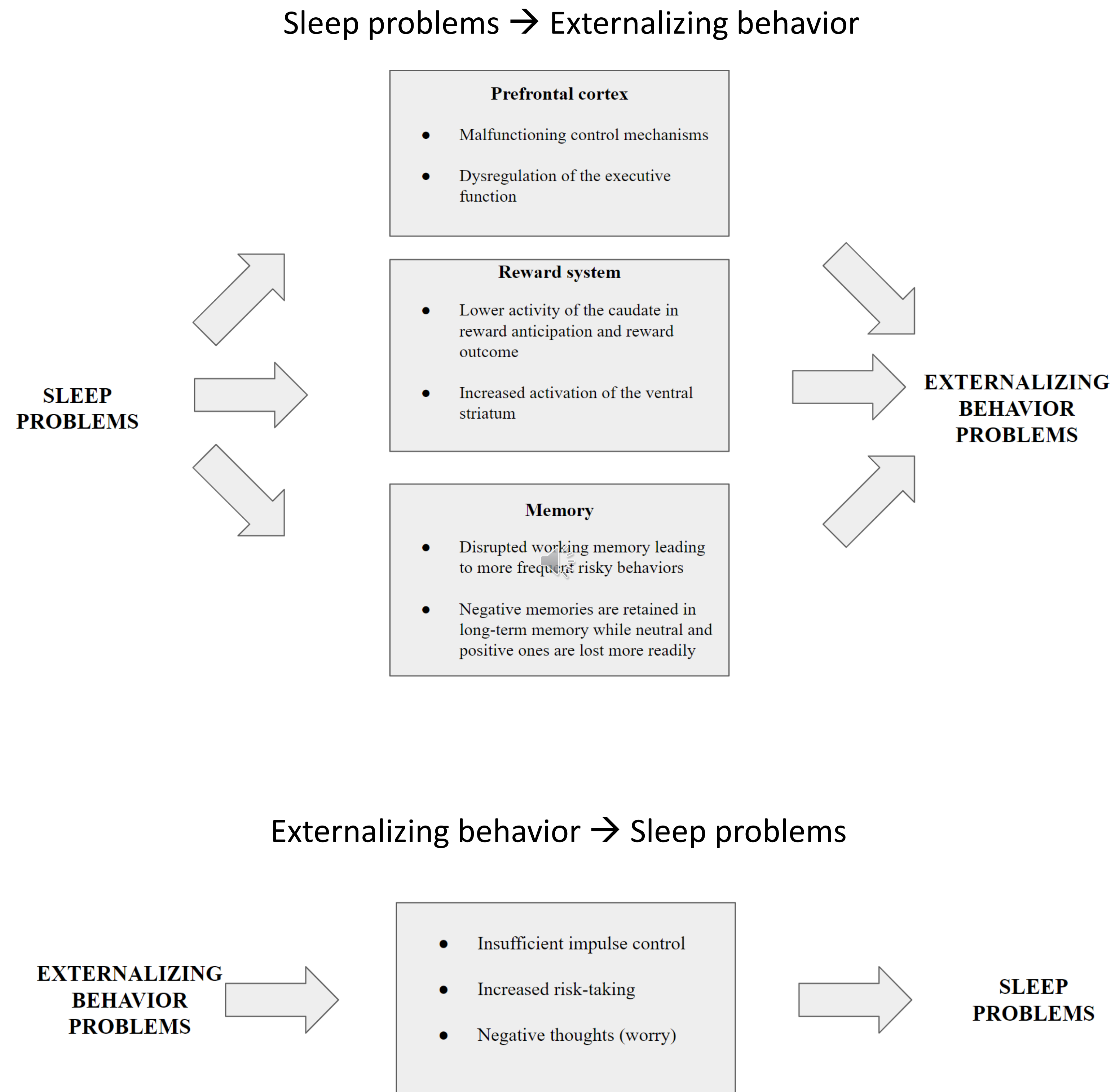
- The interrelated relationship between sleep problems and behavior problems is by now well-documented. While a substantial number of systematic reviews have been conducted on the bidirectionality of sleep problems and internalizing behavior (e.g., depression, anxiety), to our knowledge this is the first systematic review providing a comprehensive analysis of a reciprocal relationship between **sleep and externalizing behavior**.
- Research has predominantly focused on the simple correlation between sleep disturbances and maladaptive behavior, and has rarely investigated the directionality of this relationship and the important question of whether sleep problems predispose to behavior problems, or vice-versa.
- Bidirectionality**: a term describing a relationship in which two variables are both causes and outcomes at the same time. Specifically, one variable affects the other variable which, subsequently, affects the first variable. In other words, variable A both predicts and is predicted by variable B. Terms "bidirectional", "reciprocal", and "two-way" are used interchangeably.
- Externalizing behavior**: a behavior directed towards the outer environment, such as aggression, hyperactivity, delinquency, impulsivity, attentional problems.

METHODS

- This systematic review was performed in compliance with PRISMA guidelines in order to provide valid reporting in this systematic review.
- Five search engines were used to identify articles eligible for inclusion: Google Scholar, PubMed, PsycINFO, Scopus, and Web of Science.

	Inclusion Criteria
Study Design	<ul style="list-style-type: none"> Cross-sectional and longitudinal research was taken into consideration.
Sample	<ul style="list-style-type: none"> Community and clinical human populations were a target of database searches.
Exposure & Outcome	<ul style="list-style-type: none"> The type of exposure and the type of outcome had to be considered simultaneously within inclusion criteria. In order to be included, studies needed to directly assess sleep, externalizing behavior, and their bidirectional association.

MECHANISMS



RESULTS

- Out of a total of 3,753 studies found, 18 were suitable for this systematic review.
- 77.8% (n=14) of the studies reported a significant bidirectional relationship between sleep and externalizing behavior. Of these, nine focused on general sleep problems, whereas five focused on specific sleep problems: sleep duration, sleep quality, insomnia, and sleep/wake problems.
- Controlling for baselines for either sleep or behavior could be important in order to examine whether such manifestations are the result of outcomes of underlying sleep or behavior problems or truly causal relationships. However, among the studies we selected, only four were explicitly controlling for baseline sleep and/or behavior problems.
- Most studies (n = 17) employed subjective sleep measures, while four studies employed objective measures, and three of these studies used both subjective and objective instruments.

DISCUSSION

- Heterogeneous methodological approaches and outcomes prevent us from reaching any definite conclusions but the best available evidence leads us to believe that claims regarding two-way causality of sleep and behavior are warranted.
- Using subjective sleep measures alone might bring result in questionable findings. The fact that majority of studies did not use objective sleep measures constitutes a major limitation of most studies included in this systematic review.
- Many studies included in the current review suggested that there are a number of alternative factors contributing to the observed bidirectionality between sleep and externalizing behavior, such as internalizing problems, comorbidities, and genetic as well as environmental factors.

CONCLUSIONS

- Overall, the literature on the subject of bidirectional relationship of sleep and externalizing behavior suggests that reciprocal associations between these two variables exist.
- More studies applying objective sleep measures and focusing on specific sleep disturbances and externalizing symptoms are needed to establish causal associations between specific facets of sleep and behavior problems.
- Future research into this bidirectionality was suggested to be of clinical significance: both sleep and behavioral symptoms, rather than one but not the other, may be targeted in therapy to effectively tackle a self-perpetuating deleterious sleep-mental health cycle.

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