Objective: To examine associations between sleep problems during development and subsequent emotional and behavioral difficulties.

Design: Prospective longitudinal study.

Setting: The Dutch province of Zuid-Holland.

Participants: At time 1 of data collection, a representative sample of 2076 children aged 4 to 16 years participated in the study.

Outcome Measures: Parents rated their children’s (4-19 years old) sleep at 5 assessments by completing the Child Behavior Checklist. Participants reported on their own emotional and behavioral symptoms at a later assessment (when aged 18-32 years) by completing the Young Adult Self-Report.

Results: After adjusting for sex, age, socioeconomic status, and parent-rated scores through development for the difficulty being predicted, having any parental reports of sleeping less than others was a risk indicator of high scores on the Anxious/Depressed scale (odds ratio, 1.43; 95% confidence interval, 1.07-1.90; P = .01) and the Aggressive Behavior scale (odds ratio, 1.51; 95% confidence interval, 1.13-2.02, P = .005). There was some (albeit less robust) support for links between other reported sleep difficulties and later problems. Parental reports of sleeping more than others and nightmares were not associated with later difficulties.

Conclusions: Physicians should inquire about sleep problems during child development and should be aware that some, but perhaps not others, may constitute risk indicators of later difficulties.

Sleep problems are risk indicators of later emotional difficulties in childhood and adolescence, and in adulthood, as well as across these developmental periods. Although most research, to date, has focused on symptoms of insomnia in association with emotional difficulties, there is emerging evidence that other sleep and sleep-related problems (referred to herein as sleep problems) may also be linked to subsequent difficulties that are not only emotional but also behavioral. Indeed, results of one study demonstrated that a composite of different sleep problems predicted symptoms of anxiety and depression, attention problems, and aggression later in life. For knowledge concerning links between sleep problems and later emotional and behavioral difficulties to be maximally beneficial to the physician, clarification of which particular sleep problems are associated with later difficulties is paramount. Toward this aim, this article documents associations between parental perceptions of 6 aspects of sleep (examined during development) and subsequent self-reported emotional and behavioral difficulties in a representative sample of 2076 participants from Zuid-Holland. This study is novel in allowing comparison of different types of sleep problems as predictors of different types of later behavioral and emotional problems. Based on previous research, associations between different aspects of sleep and different types of emotional and behavioral problems were expected, but hypotheses concerning specific patterns of association were considered premature.
PARTICIPANTS

Participants are members of a longitudinal study examining the development of a representative sample of children from the Dutch province of Zuid-Holland. The original sample consisted of children aged 4 to 16 years drawn from municipal registers that listed all residents. A random sample of 100 children of each sex and each age with Dutch nationality was drawn in 1983 (N=2600). Of the parents of the 2447 target children who were reached, 2076 (84.8%) completed the Child Behavior Checklist (CBCL), which is a parent-report questionnaire that assesses emotional and behavioral problems in 4- to 18-year-olds by means of 120 items. This first assessment constituted time 1 of data collection. At time 1, the mean (SD) age of the participants was 9.93 (3.75) years, and approximately half of the participants were boys (1016 [48.9%]). Participants were mainly white (2006 [96.6%]) and came from socioeconomic status (SES) backgrounds in the full range (1131 participants [54.7%] came from families in the lowest 3 SES groups, with the remaining 938 [45.3%] from families in the top 3 SES groups). Follow-up studies were performed in 1985 (time 2; CBCL data collected on 1412 participants aged 6-17 years), 1987 (time 3; CBCL data collected on 1374 participants aged 8-19 years), 1989 (time 4; CBCL data collected on 1116 participants aged 9-18 years), 1991 (time 5; CBCL data collected on 954 participants aged 12-19 years), and 1997 (time 6). At time 6, we focus on data collected on 1615 participants aged 18 to 32 years using the Young Adult Self-Report (YASR). Selective attrition in the Zuid-Holland sample is reported elsewhere (participants leaving the study were more likely to be boys, to be from lower SES groups, to be older at time 1, and to have greater problems as assessed using the CBCL at time 1). Each assessment was approved by the Committee for Medical Ethics, University Hospital/Erasmus University, Rotterdam. Informed consent was obtained from each participant after the procedures were fully explained.

MEASURES

Socioeconomic Status

The SES at time 1 was measured using a 6-point scale of parental occupations, with 1 as the lowest SES and 6 as the highest. If both parents worked, the higher occupational level was used.

Sleep

Sleep was assessed by 6 items on the CBCL: “sleeps less than most kids,” “overtired,” “trouble sleeping,” “nightmares,” “sleeps more than most kids during day and/or night,” and “talks or walks in sleep.” These items have been considered in relation to emotional and behavioral problems previously. As with other items on the CBCL, parents were asked to describe their child now or within the past 6 months (0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true). For each of the 6 sleep items, dichotomous variables were made that (1) compared participants for whom parents had responded 1 (somewhat true) or 2 (often true) at 1 or more time points with those who had not been given a score of 1 or 2 at any of the assessments and (2) compared participants for whom parents had responded 2 (often true) at 1 or more time points with those who had not been given a score of 2 at any of the assessments. According to the first criterion, 693 children (33%) were reported to sleep less than others, 603 (29%) were reported to be overtired, 451 (22%) were reported to have trouble sleeping, 373 (18%) were reported to have nightmares, 377 (18%) were reported to sleep more than others, and 799 (39%) were reported to talk or walk during their sleep. Regarding the second criterion, 275 participants (13%) were reported to sleep less than others, 84 (4%) were reported to be overtired, 183 (9%) were reported to have trouble sleeping, 61 (3%) were reported to have nightmares, 150 (7%) were reported to sleep more than others, and 248 (12%) were reported to talk or walk during their sleep.

Emotional and Behavioral Difficulties During Development

The Anxious/Depressed, Attention Problems, and Aggressive Behavior scales were also examined using the parent-report CBCL and were controlled for in certain analyses. None of these scales included sleep problems. These 3 scales were focused on to maximize comparability with previous research of this type. The Anxious/Depressed scale consists of 14 items (eg, “cries a lot” and “too fearful or anxious”), the Attention Problems scale consists of 11 items (eg, “daydreams or gets lost in his/her thoughts” and “acts too young for his/her age”), and the Aggressive Behavior scale consists of 20 items (eg, “physically attacks people” and “screams a lot”). The reliability and validity of the Dutch version of the CBCL has been demonstrated previously.

Emotional and Behavioral Problems at Time 6

The Anxious/Depressed, Attention Problems, and Aggressive Behavior scales were obtained using the YASR. The Anxious/Depressed scale includes 17 items, the Attention Problems scale includes 7 items, and the Aggressive Behavior scale includes 12 items. Items overlap with those in the CBCL, and example items reported previously for the CBCL scales are included in the YASR scales. Items are scored in the same way as for the CBCL. Good reliability and validity for this measure have been reported in the English and Dutch versions. The 18-day test-retest reliability for the total problem score in a general population sample was high (r=0.89). Because each variable was positively skewed, and to make the analyses as clinically relevant as possible, each scale was dichotomized so that participants scoring in the top 15% in the entire data set were compared with the other participants. Many of the results reported herein were replicated when using other cutoff points (eg, 25%).

STATISTICAL ANALYSES

Links between parent-reported sleep problems and later self-reported emotional and behavioral difficulties were established using 2-tailed tests. The prediction of emotional and behavioral difficulties at time 6 from sleep items at times 1 to 5 was established using logistic regression. Two different models examined the prediction of emotional and behavioral difficulties. Model 1 examined the unadjusted odds ratio (OR) for sleep problems predicting emotional and behavioral difficulties. Model 2 examined the OR for sleep problems predicting emotional and behavioral difficulties after adjusting for the effects of sex, age at time 1, SES, ethnicity, and parent-rated scores through development for the problem being predicted (eg, Anxious/Depressed scores during times 1 to 5 when predicting Anxious/Depressed scores at time 6).
RESULTS

SLEEP PROBLEMS “SOMEWHAT” OR “OFTEN” AND SUBSEQUENT EMOTIONAL/BEHAVIORAL PROBLEMS

Participants reported during development to sleep less than others, show overtiredness, have trouble sleeping, and experience nightmares were more likely than those not reported to have these difficulties to score highly on the Anxious/Depressed scale at time 6 (Figure A). After adjusting for sex, age, SES, and parent-rated scores through development for Anxious/Depressed, Attention Problems, and Aggressive Behavior scales of the Child Behavior Checklist at time 6. *P<.01, †P<.05, ‡P<.10.

Figure. Parent-reported sleep problems during child development and later self-reported anxious/depressed problems (A), attention problems (B), and aggressive behavior (C). Participants with a “sleep problem” have been reported to have a problem “somewhat or often” at 1 or more assessment times (1-5). Those with later problems score in the top 15% for the Anxious/Depressed, Attention Problems, and Aggressive Behavior (C). Participants with a “sleep problem” have been reported to have a problem “somewhat or often” at 1 or more assessment times (1-5). Participants reported during development to sleep less than others and to experience nightmares were more likely than others to score highly on the Attention Problems scale at time 6. There was also a nonsignificant trend for those with trouble sleeping to be more likely than others to score highly on the Attention Problems scale (Figure B). After adjusting for sex, age, socioeconomic status, and parent-rated scores through development for attention problems, none of these associations were significant, and high Attention Problems scores were predicted only by reports of talking or walking during sleep (OR, 0.69; 95% CI, 0.51-0.93; P=.02) (Table). Specifically, participants less likely to be considered to talk and walk during their sleep were more likely to consider themselves to have high attention problems later in life.

Finally, participants reported to sleep less than others, be overtired, have trouble sleeping, and experience nightmares were more likely than others to score highly on the Aggressive Behavior scale at time 6 (Figure C). After adjusting for sex, age, SES, and parent-rated scores through development for aggressive symptoms, high Aggressive Behavior scores were predicted only by sleeping less than others (OR, 1.51; 95% CI, 1.13-2.02; P=.005) (Table).

To summarize, after controlling for associated factors, “sleeping less than others” emerged as the main predic-
tor (predicting both scores on the Anxious/Depressed and Aggression Behavior scales). Nightmares, sleeping more than others, and talking and walking during sleep were not risk indicators for later problems (indeed, parental reports of talking and walking during sleep were associated with a lower incidence of self-reported attention problems later in life).

SLEEP PROBLEMS “OFTEN” AND SUBSEQUENT EMOTIONAL/BEHAVIORAL PROBLEMS

When using stricter criteria to assess sleep problems (those for which parents had responded “very true or often true” to the item during development), a similar pattern of results emerged. After adjusting for sex, age, SES, and parent-rated scores through development for anxiety/depression symptoms, sleeping less than others was the only sleep difficulty to predict later Anxious/Depressed scores (OR, 1.51; 95% CI, 1.05-2.15; P = .03). Regarding high Attention Problems scores, after adjusting for sex, age, SES, and parent-rated scores through development for attention problems, those reported to sleep less by their parents during development were more likely than others to report high Attention Problems scores at time 6 (OR, 1.47; 95% CI, 1.02-2.12; P = .04). Finally, after adjusting for sex, age, SES, and parent-rated scores through development for aggressive behavior, “sleeps less than others” was the only variable to significantly predict later aggressive behavior (OR, 1.60; 95% CI, 1.11-2.29; P = .01).

COMMENT

Three findings from this investigation are particularly noteworthy. First, participants considered by their parents to sleep less than others during development were more likely than others to report high levels of difficulties assessed later in life; hence, parental reports of sleeping less than others seems to be the most robust predictor of these later problems. Second, there was some (albeit less robust) support for links between parental perceptions of other sleep problems (overtiredness and trouble sleeping) and later difficulties. Because a greater proportion of participants were reported to sleep less than others compared with experiencing overtiredness or trouble sleeping, it would be inappropriate to make claims about the specificity of sleeping less than others as a predictor of certain later difficulties. Third, parental reports of 3 sleep problems (nightmares, sleeps more than others, and talks and walks in sleep) did not seem to be risk indicators of any later difficulties. Indeed, there was some indication that participants reported to talk and walk during sleep during development were less likely to report attention problems later in life. The absence of a link between parental perception of sleeping more than others and later difficulties was somewhat surprising given the known predictive links between hypersonia and depression, although the present study encompasses developmental stages and time frames not assessed previously.

LIMITATIONS

There are 3 main limitations of this work. The first limitation concerns attrition: it was not possible to obtain data regarding each participant at each time point. To combat the possibility that families taking part in more assessments were more likely to be considered to have a sleep problem (eg, they had a greater opportunity to endorse items), all analyses were re-run on a subgroup of participants who had provided data at every time point. A similar pattern of results was obtained.

The second limitation concerns the measures. Repeated assessments of 6 single parent-reported CBCL items were used to assess sleep problems. Focusing on a few items to assess sleep difficulties is common in large-scale studies of this type, although it should be noted that actigraphy studies suggest that parental reports are not adequate for assessing certain aspects of sleep (eg, sleep quality). Because the CBCL sleep items have not been validated against objective data, it is important to emphasize that this study focuses on parental perceptions of sleep, which could be different from objective sleep difficulties. Supplementary measures of sleep would have been informative. An additional issue concerns the way in which sleep problems were conceptualized. Despite the advantage of using multiple approaches to assess sleep problems (those reported to “somewhat or often” have sleep problems and those reported to “often” have sleep problems), it would have been equally valid to have conceptualized sleep problems in other ways. Indeed, preliminary analyses examining “persistent” sleep problems (problems reported at ≥2 time points) found similar patterns of results for unadjusted analyses, although the associations disappeared after adjusting for associated factors in regression analyses. This suggests that the results of this study are not necessarily relevant to sleep problems conceptualized in different ways, and further research should address this point.

Another issue concerning measurement was that parents were rating child difficulties, so it would have been advantageous to have controlled for parental sleep and behavioral and emotional problems in the analyses. However, this was not possible because these factors were not measured. An additional point is that certain aspects of the measure used to assess emotional and behavioral difficulties were not ideal. For example, combining anxiety and depression into a single scale may have masked specific associations with sleep problems because it is likely that sleep difficulties during development are associated with subsequent anxiety and depression in different ways, as suggested by the mixed results of recent studies. Nonetheless, we focused on the published scale because factor analyses have suggested that the anxious and depressed items on this scale go together empirically. Furthermore, the YASR is widely used and well-validated, and its use is considered appropriate given the power limitations of alternatives (diagnoses of various disorders were made according to the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders but were too infrequent to be considered in these analyses). Furthermore, the use of different raters to assess sleep problems during development and emotional
and behavioral difficulties at time 6 is considered to be an advantage of this study. The final limitation is that the participants varied in age, so conclusions concerning sensitive periods regarding different sleep problems in relation to later difficulties cannot be drawn, and this remains an area for future study.

INTERPRETATION

Short sleep has been linked to various problems previously, and research suggests that insufficient sleep may lead to difficulties with emotional and behavioral regulation and cognitive functioning. Furthermore, short sleep during adolescence has also been shown to predict later depression. What is novel here is that when adjusting for parent-rated scores through development for specific emotional and behavioral difficulties, there are longitudinal associations between parental perceptions of short sleep and self-reported emotional and behavioral difficulties, and short sleep compared with other sleep problems seemed to be a particularly robust risk indicator of later difficulties. A tentative explanation for these associations is that short sleepers function less well during the day (e.g., underachieving, experiencing interpersonal difficulties, and having accidents) and that this poor functioning is associated with the emergence of later emotional and behavioral difficulties. A further possibility is that shared genes or environmental factors help explain these associations, and research has highlighted genetic overlap between the concurrent association between sleep and externalizing problems. The significance of short sleep as a risk indicator of later problems underscores a study demonstrating a general trend for increasingly short sleep duration across childhood and adolescence.

The possible significance of parental perceptions of other aspects of sleep, such as overtiredness and trouble sleeping, fits well with the known longitudinal links between insomnia and later difficulties, and is also in line with less well-established associations between a range of different sleep problems and emotional and behavioral difficulties (e.g., high levels of depression have been reported in patients with different types of sleep disorders). As with associations between short sleep and later difficulties, explanations for links between other aspects of sleep and emotional and behavioral problems are tentative. One possibility is that links between sleep problems during development and later difficulties reflect parents’ failure to pick up or report on their children’s emotional and behavioral difficulties during development. Indeed, overtiredness may be a more appealing explanation than emotional and behavioral difficulties for extreme behavior (such as agitation). Longitudinal links could, therefore, simply reflect the known persistence of emotional and behavioral difficulties throughout life.

CLINICAL IMPLICATIONS

Additional research focusing on clinical samples is needed to further examine the associations reported herein before the full implications of this work are clear. Nonetheless, 3 possible clinical implications are proposed. First, this study could have implications for identifying individuals at risk for later difficulties. The results suggest that children reported to sleep for short periods may be at risk for later difficulties. Other aspects of sleep may also be salient. Routinely inquiring about different aspects of sleep during regular checkups may, therefore, be worthwhile. Second, this study indicates that certain sleep difficulties (e.g., sleeping more than others and experiencing nightmares) are not associated with difficulties assessed later in life. Feeding this information back to parents and children concerned by such difficulties may be reassuring. Finally, the results reported herein are consistent with the suggestion that addressing sleep problems could potentially reap long-term benefits. This chimes well with studies demonstrating that increasing sleep length has positive consequences (e.g., increasing sleep length is associated with improved neuropsychological functioning in children). Although it is important to note that sleep problems represent just 1 of many types of risk indicators of later emotional and behavioral difficulties, the relative ease at which many people can discuss their sleep and the effective treatments available for sleep problems reinforces the conclusion that further attention should be given to sleep problems that occur frequently and are regularly neglected in clinical practice.

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Correspondence: Alice M. Gregory, PhD, Department of Psychology, Goldsmiths College, University of London, Lewisham Way, New Cross, London SE14 6NW, England (a.gregory@gold.ac.uk).

Author Contributions: Dr Gregory had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Gregory, Van der Ende, and Verhulst. Acquisition of data: Van der Ende and Verhulst. Analysis and interpretation of data: Gregory, Van der Ende, and Willis. Drafting of the manuscript: Gregory. Critical revision of the manuscript for important intellectual content: Gregory, Van der Ende, Willis, and Verhulst. Statistical analysis: Gregory, Van der Ende, and Willis. Obtained funding: Gregory. Administrative, technical, and material support: Gregory, Van der Ende, and Willis. Study supervision: Van der Ende.

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REFERENCES

12. Verhulst FC, van der Ende J, Koot HM. Handreiking voor de CBCL/4-18. Rotterdam, the Netherlands: Department of Child and Adolescent Psychiatry, Sophia Children’s Hospital, Erasmus University; 1996.