Original Article

Outcomes at six years of age for children with infant sleep problems: Longitudinal community-based study

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ABSTRACT

Objectives: To examine whether infant sleep problems predict (1) sleep problems and (2) poorer outcomes at the age of six years.

Methods: We studied a community-based cohort of 326 six-year-olds recruited to a randomized trial of a behavioral sleep intervention for sleep problems at age seven months. Predictors were parent-reported child sleep problems at ages 4, 12, and 24 months ("yes" vs. "no"). There were a number of parent reported six-year-old outcomes: (1) Child sleep problem ("moderate/large" vs. "none/small") and Child Sleep Habits Questionnaire (CSHQ); (2) child and maternal mental and global health, child health-related quality of life (HRQoL, also child-reported), and child–parent relationship. The analyses were composed of multivariable models, adjusting for potential confounders and six-year sleep problems, examining whether each outcome was predicted by each infant sleep problem entered simultaneously. In a second set of analyses the predictor was the count of the number of waves with a sleep problem.

Results: A total of 225 (69%) families participated at six years. The CSHQ Total increased 0.5 points (95% CI: 0.4 to 2.4, p = 0.006) with each additional infant sleep problem, but there was little evidence that sleep problems at one or more time points during early childhood predicted other child, maternal, or child–parent outcomes at six years.

Conclusion: Infant sleep problems, whether transient, recurring, or persistent, do not predict long-term outcomes. Clinicians should focus on reducing child sleep problems and their considerable short-to-medium term impacts as they arise during childhood.

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1. Introduction

Throughout their early years, children's sleep problems – reported by approximately 20–40% of parents [1] – are associated with a substantial health burden for families. In infancy (0–2 years), they are associated with poorer maternal wellbeing, including depressive symptoms [2], and poorer general health [3]. Children with early sleep problems are more likely to have sleep problems at school-entry age (5–7 years) [4], by which time they are associated with a raft of negative outcomes including poorer child mental health, health-related quality of life (HRQoL) [5] and physical health [6], and poorer maternal mental and general health [3,7].

It remains unclear whether these important adverse associations around the time of school entry are the outcomes of earlier

sleep problems or are simply the immediate impacts of concurrent sleep difficulties. Findings from a randomized controlled trial which suggested that a behavioral sleep intervention delivered in the first six months of school leads to improved child psychosocial HRQoL, prosocial behavior and maternal mental health immediately post-intervention [8], lends some support to the latter view.

This does not eliminate the possibility, however, that a long history of childhood sleep problems extending back as far as infancy also contributes to adverse outcomes. The two studies examining how early childhood sleep problems relate to school-entry child outcomes both reported that infant sleep problems predicted later Attention Deficit Hyperactivity Disorder (ADHD) [9] and hyperactivity symptoms [10], but no studies have investigated whether early childhood sleep problems predict other childhood mental health problems, HRQoL, or general health. Similarly, while infant sleep interventions can improve maternal depression symptoms up to 16 months post-intervention [1,11], it remains unclear whether early childhood sleep problems predict maternal mental and general health in the longer term. Finally, while researchers

have hypothesized a relationship between childhood sleep problems and impaired child–parent relationships [12], none have investigated associations of both early and concurrent sleep problems with these outcomes. If ongoing (i.e., persistent or recurring) sleep problems throughout early childhood predispose children and their parents to a range of adverse outcomes at school-entry age, there may be a case for more systematically addressing sleep management throughout the early years than is currently the case [1,11,13].

The Kids Sleep Study offers an opportunity to examine the long-term outcomes of sleep problems measured prospectively and repeatedly across the first two years of life. Using a community sample of 326 children, originally recruited from a population-based survey on the basis of parent-reported sleep problems at age seven months, the aim, therefore, was to quantify the extent to which (a) sleep problems at each of 4, 12, and 24 months of age, and (b) frequency of sleep problems across these ages, predicted at child age six years:

1. Child sleep problems (primary outcome), and
2. Secondary outcomes of child mental health, HRQoL and global health; maternal mental health and global health; and child–parent relationships, after adjusting for sleep problem status at six years.

2. Methods

2.1. Design and setting

The current cohort was originally recruited for a cluster randomized trial of a behavioral sleep intervention delivered in infancy (ISRCTN48752250) [11,14]. Following a population survey of mothers attending their infants' scheduled four-month well-child check (conducted by maternal and child health [MCH] nurses across six socioeconomically diverse local government areas in Melbourne, Australia), those who reported an infant sleep problem at seven months (*N* = 328) were recruited to the Infant Sleep Study trial. Maternal and child health nurses excluded infants born <32 weeks gestation and mothers with insufficient English to complete questionnaires.

After randomization, intervention mothers were offered a behavioral sleep intervention at 8–10 months. Control families received usual care from Australian health care services which did not include the behavioral sleep intervention [11,14]. Compared to controls, intervention parents reported fewer sleep problems at infant age 10 months (56% [intervention] vs. 68% [control]; adjusted odds ratio [adj OR] 0.6 [95% CI 0.4 to 0.9]) and 12 months (39% vs. 55%; adj OR 0.5 [0.3 to 0.8]) [14], and a lasting reduction in maternal depression at two years (15% vs. 26%; adj OR 0.4 [0.2 to 0.9]) [11]. At six years there were no differences between trial arms on any child, maternal, or child–parent outcome [15]. Intervention and control groups were therefore combined into a single cohort to examine the novel question of whether early sleep problems predict later child, maternal, or child–parent outcomes at six years, independent of intervention effects from seven months to six years.

2.2. Follow-up participants and procedures

From April to October 2009 the study team re-contacted all families. Two children met pre-specified exclusion criteria (one each with intellectual disability and autism), leaving 326 eligible. Consenting parents were mailed a questionnaire and then telephoned to arrange a home-based assessment as close as practicable to their child's sixth birthday (a uniform time of follow-up that falls soon after the transition to school for virtually all Austra-

lian children). At the home visit, trained researchers administered the children's self-reported Pediatric Quality of Life Inventory (PedsQL 4.0 [16] see *Measures*, below).

2.3. Measures (all parent-reported)

2.3.1. Predictor variables (sleep)

At 4, 12 and 24 months, the primary caregiver completed the single "yes"/"no" item "Over the last two weeks, has your child's sleep generally been a problem for you?" In a community survey of 738 Australian parents, this item differentiated infants on sleep patterns including evening bedtime (*p* = 0.04), time to fall asleep, number of disturbed nights per week, number of night awakenings, and length of wake durations (all *p* < 0.001) [2]. A sleep problem frequency was created by counting the number of times a child had a sleep problem at 4, 12 and 24 months, with possible values of 1–4 since all children had a sleep problem at seven months. Although assessed at 10 months, sleep problems at this age were excluded from the count variable to meet the requirements of an ordinal variable, i.e., to assume an equal distance between each pair of consecutive points [17].

2.3.2. Six year outcome variables

2.3.2.1. Child. The single four-point item "How much is your child's sleeping pattern or habits a problem for you?" developed for the Longitudinal Study of Australian Children [7], was the primary outcome. Presence of a sleep problem ("no/small/moderate/large") was dichotomized into "no/small" vs. "moderate/large" problems. This item correlates with blinded teacher ratings of behavior and academic ability [7], and pilot data (*n* = 89 Melbourne 6-year-olds) indicate that this dichotomization corresponds best (92.3%) to the binary predictor sleep variable collected at 4, 12 and 24 months [18]. Severity of a clinical sleep problem was measured using the validated 33-item (all three-point ordinal scales) Child Sleep Habits Questionnaire Short Form (CSHQ) [19]. The Total score sums items (possible range 33–99); a higher score indicates a greater problem. In American community (*n* = 460, mean age [SD] = 7.6 [1.5] years) and sleep disordered (*n* = 154, mean age [SD] = 6.8 [1.7] years) samples, internal reliabilities for the total score were *r* = 0.68 and *r* = 0.78, respectively [19].

Mental health was assessed with the validated 25-item (all three-point ordinal scales) Strengths and Difficulties Questionnaire (SDQ 4–10-year-old version) [20–22]. Twenty items are summed to produce the Total problems score (possible range 0–40); a higher score indicates a greater problem. Australian community data from 1359 students aged 4–9 years showed good internal reliability for the Total score (*α* = 0.82). Health-related quality of life (HRQoL) was assessed with the validated 23-item (all five-point ordinal scales) Pediatric Quality of Life Inventory 4.0 (PedsQL 4.0) [23,24], which yields Psychosocial and Physical Health summary scales (possible range 0–100); higher scores represent better HRQoL. The 5–7-year-old self report version [16] – which produces the same subscales and ranges as the parent version – was also collected and administered by trained researchers at the home visit. Each item of the self report is scored on a three-point scale and children answer by pointing to faces on an A4 piece of card corresponding to the response options. Examples of items include "Is it hard for you to run?" and "Do you feel sad?" The PedsQL has shown strong internal reliabilities for parent-reported psychosocial and physical HRQoL (*α* = 0.86 and *α* = 0.87, respectively; *n* = 1111 American parents of six-year-old children) and child-reported psychosocial and physical HRQoL (*α* = 0.82 and *α* = 0.70, respectively; *n* = 914 American six-year-olds) [16,24]. Children's global health was measured with the single five-point item "In general, would you say your child's health is:" with the possible responses "poor/fair/good/very good/excellent." Drawn from the