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Separating the effects of ethnicity and socio-economic status on sleep practices of 6- to 7-month-old infants

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ABSTRACT

Infant sleep undergoes significant re-organization throughout the first 12 months of life, with sleep quality having significant consequences for infant learning and cognitive development. While there has been great interest in the neural basis and developmental trajectories of infant sleep in general, relatively little is known about individual differences in infant sleep and the socio-economic and cultural sources of that variability. We investigated this using questionnaire sleep data in a large, unique multi-ethnic sample of 6–7 month-olds (n = 174), with families from South Asian ethnic groups in the UK (Indian, Pakistani and Bangladeshi) being especially well represented. Consistent with previous data from less variable samples, no effects of SES on sleep latency or nocturnal sleep duration emerged. However, perinatal risk factors and ethnic differences did predict daytime sleep, sleep fragmentation and sleep-onset time. While these results should be interpreted with caution due to several limitations, they likely demonstrate that even when socio-economic status and ethnicity are much less confounded than in previous studies, they have a surprisingly limited impact on individual differences in sleep patterns in young infants.

1. Introduction

In children, sleep patterns are related to cognitive functioning, especially to learning and memory during the first years of life (Gomez, Newman-Smith, Breslin, & Bootzin, 2011; Hill, Hogan, & Karmiloff-Smith, 2007) and later in childhood (Ashworth, Hill, Karmiloff-Smith, & Dimitriou, 2014). Daytime naps have been shown to facilitate language learning in infants and toddlers (Gómez, Bootzin, Nadel, & Gomez, 2006; Hupbach, Gomez, Bootzin, & Nadel, 2009), while nocturnal sleep duration is associated with retention in 3-month-olds (Fagen & Rovee-Collier, 1983), and encoding and generalisation in imitative learning in 10-month-olds (Lukowski & Milojevich, 2013).

Individual differences in sleep architecture predict cognitive functioning in infancy and beyond. Clinical studies with infants younger than 12 months showed associations between sleep duration, number of awakenings and sleep morphology in EEG with concurrent and later scores in standardised developmental batteries (Becker & Thoman, 1981; Freudigman & Thoman, 1993; Scher, Steppe, & Banks, 1996; for a review see Ednick et al., 2009). Longitudinal relationships across longer periods of development have also been found for toddlers (Dearing, McCartney, Marshall, & Warner, 2001) and school-aged children (Buckhalt, El-Sheikh, & Keller, 2007; Buckhalt, El-Sheikh, Keller, & Kelly, 2009).

Sleep problems are more frequent in children with behavioural problems (Arman et al., 2011), depression (Gregory, Rijsdijk, Lau, Dahl, & Eley, 2009), ADHD (Gruber, Sadeh, & Raviv, 2000) and in several developmental disorders (Annaz, Hill, Ashworth, Holley, & Karmiloff-Smith, 2011; Ashworth, Hill, Karmiloff-Smith, & Dimitriou, 2013). There are data pointing to a longitudinal relationship between early sleep difficulties and later behavioural problems in children (Gregory & O'Connor, 2002).

Since sleeping conditions, parental care, and risk of developmental difficulties in children vary greatly with family socio-economic status (SES), several studies have examined the relationships between these factors (Mindell, Sadeh, Kohyama, & How, 2010). A particular challenge in this research is to separate cultural and ethnic influences on sleep practices from other effects of the socio-economic circumstances in which the family lives. To date, the majority of studies in Western countries (and particularly in the US) have compared people of African ethnic origin with those of European origin, with SES co-varying with ethnicity. Lozoff, Askew, and Wolf (1996) found an association between regular co-sleeping and increased night waking or bedtime protests in

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children aged 6 to 48 months from low-SES European-American and high-SES African-American families. African-American infants from higher SES families had longer but less frequent bouts of sleep compared with the lower SES group (Fouts, Roopnarine, & Lamb, 2007). In a group of 8- to 9-year-olds, higher SES moderated the effects of sleep disruptions on cognitive performance. After controlling for SES, ethnic differences in sleep emerged with the African-American group showing greater variability in sleep-onset time, shorter sleep duration and higher incidence of co-sleeping and of sleep problems (Buckhalt et al., 2007). Critically, African-American children were at increased risk of lower cognitive performance when sleep problems were present, suggesting that cultural practices may play a significant role in negotiating the extent of cognitive impairments when sleep problems persist. In another study of pre-schoolers, ethnic differences (White/Latino/African-American) were identified for sleeping arrangements, falling asleep routines, and the rate of sleep-related concerns after controlling for SES (Milan, Snow, & Belay, 2007).

To date, the majority of studies compared the effects of ethnicity and SES on sleep in samples with very few ethnic groups, which often simultaneously differed in their income and social status. In order to separate out these effects, it is crucial to study samples with greater ethnic diversity and income variability. Motivated by this deficiency, we investigated this issue in a unique multi-ethnic sample of infants aged 6–7 months, which had a far more diverse range of ethnicities than assessed in previous studies and high SES variability that was more distributed across different ethnicities.

2. Methods

2.1. Data collection sites

The study was conducted in community settings, in seven Sure Start Children Centres (United Kingdom), located in areas with the highest levels of multiple deprivation nationwide (ranked 3–30% of most deprived areas in England). Participating families were identified by Children's Centre staff through birth registers and/or registers of public service users. Information about the study was mailed to each eligible family in the catchment area of each Centre, and distributed by practitioners among families during their visits to target Centres. All eligible families that expressed interest in the study were scheduled to take part. While every effort was made to inform all eligible users about the study, due to limited user registers it was not possible to precisely measure the number of families who declined to participate, although Centre managers' estimates ranged between 35% and 67%. While special care was taken to recruit teenage parents, only three such families took part. An equal proportion of participants came from Children's Centres in each borough. For a complete description of the broader study design, sample characteristics, and recruitment procedures see Ballieux et al. (2016).

2.2. Participants

The final infant sample consisted of 174 infants aged between 6 months 1 day and 7 months 30 days (M = 209.26 days 29.45 weeks), with 68 girls (39.1%) and 106 boys (60.9%). We note higher than expected sex ratio in the sample but on the basis of existing literature we could not establish beyond reasonable doubt any explanation related to cultural or socio-economic factors. Ethnicity data were obtained using a standard UK government form. Reflecting the diverse ethnic composition of East London, the final sample comprised 33 (15.3%) White British, 26 (11.2%) Other White, 20 (11.8%) Afro-Caribbean, 41 (21.2%) Asian Indian/Pakistani, 26 (14%) Asian Bangladeshi, and 28 (26.5%) Mixed/Other ethnicity infants, originating from different countries, and speaking different languages. More than half of the families had English as their first language (58.6%), with 71.3% reporting more than one language being used at home. All infant participants included in the sample were born full-term (36–42 weeks gestational age, M = 39.5 weeks, SD = 1.5), with birth weight ranging from 2000 to 5400 g (M = 3229.1, SD = 501.5, twelve infants below 2500 g). The following exclusion criteria were used: preterm birth (<36 weeks), an older sibling with autism, any major delivery complications or major medical conditions (genetic, metabolic or other chronic illness), maternal use of recreational drugs during pregnancy. Fifty-eight per cent of infants were breastfed at the time the data were collected.

The study received ethical approval from the local university board and from Tower Hamlets local government authority. All parents gave written informed consent and received small gifts in return for their participation.

2.3. Sleep measure

Infant sleeping patterns were reported by parents during the interview with the experimenter, who asked questions from the Brief Infant Sleep Questionnaire (Sadeh, 2004) and recorded the responses. BISQ is a popular screening tool for infants and toddlers, with good reliability, and superior clinical validity in comparison with actigraphy (but see Section 4.5). For the period of the week preceding testing at the Centre, the parents reported: nocturnal (7 pm–7 am) and daytime (7 am–7 pm) sleep duration, duration of wakefulness at night (10 pm–5 am), number of night wakings, nocturnal sleep-onset time (clock time at which the child falls asleep at night) and settling time (latency to fall asleep for the night). Additional questions were asked for preferred sleeping position (on back, side, belly; parents could report all three), the most common method of falling asleep (while feeding, being rocked, held, in bed alone, in bed near parent), the usual location of sleep (parent's bed, crib in parent's room, crib in separate room, crib in room with sibling) and whether the parents considered the infant's sleep problematic.

2.4. Demographic data collection

During their first visit to the local Children's Centre to participate in the infant development study, parents were asked by the experimenter an extensive set of questions regarding family demographic information, socio-economic status, infant birth, sleep and medical history. Thus all socio-economic data comes from parental self-report. Either the mothers (96% of sample) or the fathers (4%) participated in the study with the infant and answered all questions.

2.5. Statistical analyses

Between-group comparisons of ethnic and SES differences in sleeping arrangements were carried out using chi-square statistics. Analogous comparisons of sleep durations were carried out using one-way ANOVAs, with additional Bonferroni-corrected pairwise comparisons, where necessary. Sleep duration data met parametric test assumptions, except for nocturnal wakefulness and latency to fall asleep, which were log-transformed to achieve normal distribution. Ethnic differences in the number of night wakings (range: 0–10) were analysed using non-parametric Kruskal–Wallis test.

Hierarchical multiple regression analyses were conducted to establish whether family characteristics, perinatal risk factors, maternal and paternal SES gradients and breastfeeding predicted infant sleep duration at 6–7 months of age beyond the effects of ethnicity. Predictors were selected on the basis of previous literature concerning sleep and cognitive development (Buckhalt et al., 2007). Ethnicity was entered in the first step, with the remaining predictors being entered in the second step. Where necessary, dependent variables were analysed after log-transformation (see above). Parametric variables were mean-centred. Preliminary regression analyses (not reported here) investigated potential interactions between SES measures (income, parental occupation and education) and ethnicity and did not yield