Project Details	
Project Code	MRC23NMHBa Bedford
Title	All too (un)predictable? The effect of environmental predictability and sensory sensitivities on sleep problems in autism
Research Theme	Neuroscience and Mental Health
Summary	Sensory hyper-sensitivity and sleep problems are common in autistic children. This project aims to investigate the role of environmental predictability and sensory sensitivities in sleep problems in both neurotypical and autistic pre-schoolers, via an online, large-scale community sample and a pilot intervention study in autistic pre-schoolers. The PhD includes advanced methods training in eye-tracking and structural equation modelling.
Description	Understanding predictors of sleep quality is of key importance given the widespread effects of poor sleep on child behaviour (Pesonen et al., 2009) and mental health (Cook et al., 2020). White noise (a sound with equal intensity at every frequency within human hearing) is commonly used to improve sleep quality in neurotypical (NT) and autistic children. Indeed, 44% of parents of autistic children report using white noise as a sleep aid and 60% rated it as effective (Williams et al., 2006). However, a recent systematic review concluded there was limited evidence for its efficacy and argued that there is a clear need for intervention studies that exploit objective measurement of sleep (Reidy et al., 2021). One mechanism by which white noise might improve sleep is 'masking' of external noises. Contemporary Bayesian and Predictive coding theories propose that autistic perception is driven more by 'bottom-up' sensory information than 'top-down' predictions based on prior experience (Pellicano & Burr, 2012; Van de Cruys et al. 2014). Our own work in infants with an autistic sibling showed that increased sensitivity to sensory stimulation contributes to sleep difficulties (De Laet et al., 2022). Interventions enhancing environmental predictability (e.g. white noise, which reduces signal-noise-ratio, decreasing arousal and disturbance; Lopez et al., 2002) may therefore be particularly beneficial for children with autistic traits and sensory sensitivities. Research questions 1) Does sensitivity to environmental unpredictability moderate the effect of sensory sensitivities on sleep quality? 2) Does increased environmental predictability (continuous white noise) improve sleep quality in NT and autistic pre-schoolers? Pre-schoolers (3-5 years; the age when autistic traits become measurable) will be recruited via existing databases (Bath Babylab, Centre for Applied Autism Research, Wales Autism Research Centre), social media and charity partners (Early Years Alliance and National Childbirth Trust). Study 1: Sensory sensitivities and sleep quality. Online, parent-report questionnaires will enable collection of a large, community sample (N=350), including: sleep quality, sleep strategies (e.g. existing use of white noise), coping with unpredictability, sensory sensitivities, and autistic traits (and scope for student-chosen measures). Structural equation models will test whether coping with unpredictability moderates the link between sensory sensitivities and sleep quality. Study 2: White noise pilot intervention. This involves a within-subject, one-week intervention in autistic and NT pre-schoolers (N=35/group). A delayed control design will be used (50% participants randomly allocated to 'sleep as usual' condition, before

taking part in the intervention). Parents who do not currently use white noise will play continuous night-time white noise at 50-55 dB for a week. Initial focus groups with parents of poor sleepers and autistic adults will give qualitative insights into the use of white noise as a sleep aid, and provide feedback on the study design. Intervention feasibility and acceptability will be measured via parent survey, retention rate and objective adherence (nights wearing actigraphy). Efficacy estimates for the intervention primary outcome, sleep duration (via actigraphy), will be analysed, along with secondary sleep outcomes. Preliminary evidence for moderation by lab-measures of unpredictability (student designed tasks: e.g. psychophysical audio thresholds, pupil dilation oddball paradigms) will be used to provide effect size estimates for a future well-powered randomised control trial. This project has the potential to provide important insight into the mechanisms underlying sensory sensitivities and sleep in NT and autistic children. By using robust methodology and an interdisciplinary approach, combining developmental psychopathology, experimental methods and biostatistics, this provides an ideal PhD opportunity.

Supervisory Team

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