

A randomised control trial of an individualised and AI-assisted nap-optimisation protocol in emerging adults with subclinical insomnia, depression, and anxiety

Is napping good or bad for our mental health? Existing studies offered piecemeal and contradictory answers. This 'napping paradox' is at least partly a result of the differences in the study populations and the lack of specification of napping features, as well as the cross-sectional correlational design commonly used. Without unequivocal evidence, sleep authorities generally warn the public about the potential detrimental effects of napping on nighttime sleep, particularly for individuals with insomnia. Healthy individuals are loosely recommended to nap as needed or wanted, earlier in the day and for a short duration. The handful of clinical guidelines addressing napping tends to neglect specific factors, e.g. napping frequency, reasons, intentionality, and regularity. Even less has been done in understanding and optimising the effects of napping, and none, to our knowledge, in individuals with subclinical symptoms of insomnia, depression or anxiety, which are highly prevalent in the community, especially in university students. In this randomised control trial, a novel personalised nap-optimization protocol will be conducted, based on individuals' naturalistic nap-mood pattern (Nap-Op intervention group, n=150), in addition to a general sleep health education (SH) for all participants (SH only control group, n = 100). Over 28 days (and nights), we shall comprehensively monitor the associations of napping behaviours and rest activity rhythms (RAR) with subsequent nighttime sleep quality and self-reported cognitive-affective states, using actigraphy watches, portable electroencephalographic (EEG) headbands, sleep diaries, and ecological momentary assessments (EMA). Utilising the deep learning approach of Hidden Markov Modelling (HMM) to quantify the 24-hour continuous patterns of activity (wake) and rest (daytime napping and nighttime sleep), in conjunction with other napping characteristics gathered through both objective tools and self-reports, we shall conduct the nap-optimization protocol to give napping recommendations on timing, duration, and frequency in planning for naps, based on the identified individualised RAR patterns as predictors of sleep and cognitive-affective states. To evaluate the efficacy of the nap-optimization protocol, in comparison to the general napping recommendations focusing on contraindications and precautions, we shall analyse the within- and between-group differences in mood outcomes, nighttime sleep quality, and also RAR, baseline and post-intervention. Assisted by machine learning, tracking technologies, and sophisticated statistical analyses, this study will help identify the 'who' (baseline individual characteristics as moderators) and the 'how' (behavioural and EEG features of naps) for optimising napping as an individualised evidence-based practice to achieve the goal of precision beyond medicine to community health for all.