Multi-behaviour associations of sleep, physical activity, and nutrition (SPAN) with major adverse cardiovascular events

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Background: Sleep, physical activity, and nutrition (SPAN) are major modifiable risk factors for the prevention of cardiovascular disease. We examined the combined multi-behaviour associations of SPAN with the risk of major adverse cardiovascular events (MACE) and its subtypes (incident myocardial infarction (MI), heart failure (HF), and stroke).

Methods: This prospective cohort analysis included 53,242 participants from the UK Biobank (median age: 63.0 years; 34.0% male) who wore trackers for 7 days and self-reported dietary data. Wearable-measured sleep (hours/day) and moderate to vigorous physical activity (MVPA; mins/day) were calculated using a machine learning based schema. A 10-item diet quality score (DQS) assessed the intake of vegetables, fruits, fish, dairy, whole grains, vegetable oils, refined grains, processed and unprocessed meats, and sugary beverages. Cox proportional hazards models were used to estimate hazard ratios (HR) for MACE risk across 27 separate joint tertile combinations of SPAN behaviours with the lowest tertile for all three as the referent group. We examined the dose-response associations of SPAN with MACE using a composite score from 0-100. Each behaviour was equally weighted, with higher scores reflecting more optimal levels of each exposure.

Results: Over the 8.0-year median follow-up time, 2,034 MACE events occurred. Compared to the referent group of combined SPAN exposure (lowest tertiles for all three), the optimal SPAN combination involving moderate sleep duration (8.0-9.4 hours/day), high MVPA (42-104 mins/day), and a DQS between 32.5 and 50.0 was associated with an HR of 0.43 (95% CI: 0.30-0.62). Compared to the minimum SPAN score of 17.8, a median SPAN score of 52.8 was associated with a 41% reduced risk of MACE (HR: 0.59; 95% CI: 0.49, 0.70). For specific subtypes, the median SPAN score corresponded to an HR of 0.53 (95% CI: 0.38, 0.75) for heart failure (HF), 0.65 (95% CI: 0.50, 0.84) for myocardial infarction (MI), and 0.52 (95% CI: 0.38, 0.71) for stroke.

Conclusions: This study highlights the combined health importance of SPAN for the prevention of MACE. Future public health strategies may benefit from adopting multi-behavioural approaches that leverage the synergistic effects of SPAN.