

Development of an interactive tool to personalize the prescription of 24-hour time use for optimal cognitive health

Maddison L Mellow (1), Tyman E Stanford (1), Timothy Olds (1), Aaron Miatke (1), Ashleigh E Smith(1) , & Dorothea Dumuid (1)

1) Alliance for Research in Exercise, Nutrition and Activity (ARENA) Research Centre, Adelaide University, Australia

BACKGROUND

- > Identifying the optimal balance of physical activity (PA), sleep, and sedentary behavior (SB; i.e., ‘time use’) in the 24-hr day may be a promising dementia prevention strategy [1].
- > The ‘optimal 24-hr day’ for brain health may vary widely between individuals depending on current 24-hr time use and health/sociodemographic characteristics [2].
- > Computing personalized optimal 24-hr day is statistically possible, but communicating such complex behavior change recommendations in real time is challenging

AIMS

To create an interactive web app which computes and communicates personalised optimal 24-hr time-use prescriptions for cognitive health. This app was used to inform intervention prescription for a 24-hr time-use RCT, *Small Steps*.

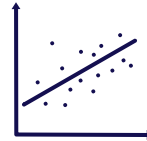
STUDY MEASURES

Participants: n=53,057 from UK Biobank [3]. Mean age = 62.2 ± 7.7 yrs, 56.7% female, 97.2% White ethnicity, mostly College/University educated (46.6%).

Time use measure: 7 days accelerometry data averaged to create mean composition: time spent in SB, sleep, light PA and moderate-vigorous PA per day. Expressed as isometric log-ratios using compositional data analysis methods.

Personalization factors: Health and sociodemographic factors (i.e., age, sex, and history of modifiable dementia risk factors) collected via questionnaire.

Cognitive function: measured across 5 domains (memory, processing speed, executive function, reasoning, and global cognition).

- METHODS
-  1) Multiple linear regressions (containing main effects, polynomial terms and all possible interactions) tested associations between 24-hr time-use composition and each cognitive outcome, adjusted for personalisation factors (modifiable dementia risk factors)
-  2) Group LASSO regularization generated most parsimonious model for each cognitive outcome
-  3) Stratified sample into eight strata, splitting by age (<65/>65 years), sex (male/female), BMI (with obesity/without obesity)
-  4) Within each stratum, constrained time-use composition ‘footprint’ to 80th percentile to ensure predicted optimal days were feasible
-  5) Used regression models to predict cognitive performance for all possible time-use compositions in feasible footprint
-  6) Calculate **optimal 24-hr day** for each outcome (the mean composition associated with top 5% of cognitive scores)

INTERACTIVE TOOL LAYOUT

We co-designed a user-friendly interface with 8 older adults and 4 allied health professionals. Figure 1 shows the computed optimal day (blue) VS. the user’s current day (gray), and the behaviour changes needed to reach their predicted optimal 24-hr day for cognition. Figure 2 shows the interactive sliders which allow users to view how small swaps between behaviours may impact their cognitive performance (i.e., taking a Small Steps approach).

 [← Read more about the methods underpinning our tool](#)

 [Read more about the co-design of the website and interactive tool interface →](#)

