Brain age estimates from different white matter microstructure features associate concordantly with bio-psycho-social factors.

Bio-psycho-social factors' associations with brain age: a large-scale UK Biobank diffusion study of 35,749 participants

Background: Brain age (BA) has previously been described as a general health marker. Yet, BA's associations with various bio-psycho-social factors have not been layed out in a structured way.

Method: BAs of UK Biobank participants (N = 35,749, 44.6–82.8 years of age) estimated from white matter microstructure features were associated with bio-psycho-social variables within the domains of sociodemographic, cognitive, life-satisfaction, as well as health and lifestyle.

Result 1a: Adding blocks of bio-psychosocial variables to a baseline model (including sex, age, & site) changed explained BA variance

significantly.



WMTI = white matter tract integrity, SMT mc = multi-compartment spherical mean technique, SMT = spherical mean technique, MEAN = whole brain average brain age, FULL = all diffusion features combined, DTI = diffusion tensor imaging, DKI = diffusion kurtosis imaging, BRIA = Bayesian rotationally invariant approach. Note that only values of $\chi^2 > 11$ were significant (p < 0.05).

Result 2: We identified various concordantly significant predictors across diffusion approaches (with the exception of socio-demographics).



Result 1b: Yet, the changes in variance explained were

relatively small: $R^2 < 3\%$.

Differences in Marginal Variance Explained from Baseline



Predictors of Brain Age

Single health and lifestyle factors were most predictive of BA, with waist-to-hip-ratio, diabetes, hypertension and related diagnoses, smoking status, coffee consumption being indicative of a higher BA. An inverse relationship was found between BA and birth weight. Finally, higher health satisfaction, self-rated health, and digit substitution scores were indicative of lower brain ages.

To the paper

Conclusion: Our results indicate BA as a general marker of health. Moreover, associations of white matter BA with biopsycho-social factors are robust to different WM diffusion modelling assumptions. A potentially fruitful guiding principal for future brain age associations research could be to focus on measures which are directly or indirectly related to or reflect pathology.

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