Development of the LIfestyle for BRAin Health' (LIBRA) score

Sebastian Köhler, Kay Deckers, Martin van Boxtel, Frans Verhey

Maastricht University, School for Mental Health and Neuroscience, Alzheimer Centrum Limburg, Maastricht, The Netherlands

From a public health perspective, those at increased risk of dementia should be identifiable based on readily available risk factors that are truly amenable to change. To this end, we developed the **Lifestyle for Brain Health (LIBRA) index**, which quantifies individual 'room for improvement' as part of the EU FP-7 INnovative, Midlife INtervention for Dementia Deterrence (In-MINDD, www.inmindd.eu) project. It consists of modifiable dementia risk factors, which can be targeted by lifestyle interventions and primary prevention strategies in primary care: physical inactivity, smoking, alcohol use, cognitive activity, Mediterranean diet, depression, hypertension, obesity, diabetes, hypercholesterolemia, coronary heart disease, renal disease.

Using the relative risks (RR) (see Deckers et al., 2015 for accompanying meta-analyses) of these twelve factors, LIBRA was calculated according to a previously reported and fairly similar approach (Anstey, Cherbuin, & Herath, 2013; Kivipelto et al., 2006). First, the natural logarithm (ln) of the RR was calculated for each factor. Second, these were standardised by taking the lowest ln (RR) as a reference value, i.e. -0.30 for low/moderate alcohol consumption, and dividing all other values by this value (See table below). Finally, individual risk scores represent the sum of the scores (range from -5.9 to +12.7) assigned to the separate risk factors.

We validate the score showing that higher LIBRA scores in midlife and early late life (up to age 75 years) indeed predicts dementia in six prospective cohort studies (3 already published). Risk increases especially if scores were in the upper 50 % of the population standard (LIBRA score >1), suggesting that prevention might be effective in this group (Schiepers et al., 2017; Vos et al., 2017). LIBRA does not predict dementia risk in the very old (Deckers et al., 2017; Vos et al., 2017). Studies in the Cardiovascular Risk Factors, Aging, and Incidence of Dementia (CAIDE) study, the English Longitudinal Study of Ageing (ELSA) and the Doetinchem Cohort Study are currently prepared for publication and show similar results. LIBRA also correlated with cognition scores in a health-seeking sample from Australia, suggesting that it might also be a useful tool for showing prevention potential in patients with subjective cognitive complaints and mild cognitive impairment (Pons et al., 2018). LIBRA is currently used to give middle-aged people from the general population insight into their own lifestyle in order to promote brain health in later life as part of the MijnBreincoach project. It is also used in the Dunedin Dementia Risk Awareness Project from New Zealand (Barak, Rapsey, Fridman, & Scott, 2018) and the National Plan for Dementia Prevention from Luxemburg. Ongoing work includes validation in clinical populations with mild cognitive impairment, correlation with biomarkers, associations with other brain outcomes (e.g. stroke) and potential for participant selection into prevention trials (in collaboration with preDIVA, FINGER).

For more information, please contact:

Dr. Sebastian Köhler, s.koehler@maastrichtuniversity.nl

Dr Kay Deckers, k.deckers@maastrichtuniversity.nl

Table showing the calculation of each factor's weight from risk estimates from existing meta-analyses (Deckers, 2017).

Risk/protective factor	Relative risk from the existing literature	Beta-coefficient (natural logarithm of the relative risk)	Weight
Low/moderate alcohol intake	0.74	-0.30	-1.0
Coronary heart disease	1.36	0.31	+1.0
Physical inactivity	1.39	0.33	+1.1
Chronic kidney disease	1.39	0.33	+1.1
Diabetes	1.47	0.39	+1.3
Cholesterol	1.54	0.43	+1.4
Smoking	1.59	0.46	+1.5
Midlife obesity	1.60	0.47	+1.6
Midlife hypertension	1.61	0.48	+1.6
Healthy diet/Medit. Diet	0.60	-0.51	-1.7
Depression	1.85	0.62	+2.1
High cognitive activity	0.38	-0.97	-3.2

Figure showing each factor's contribution to the total score.

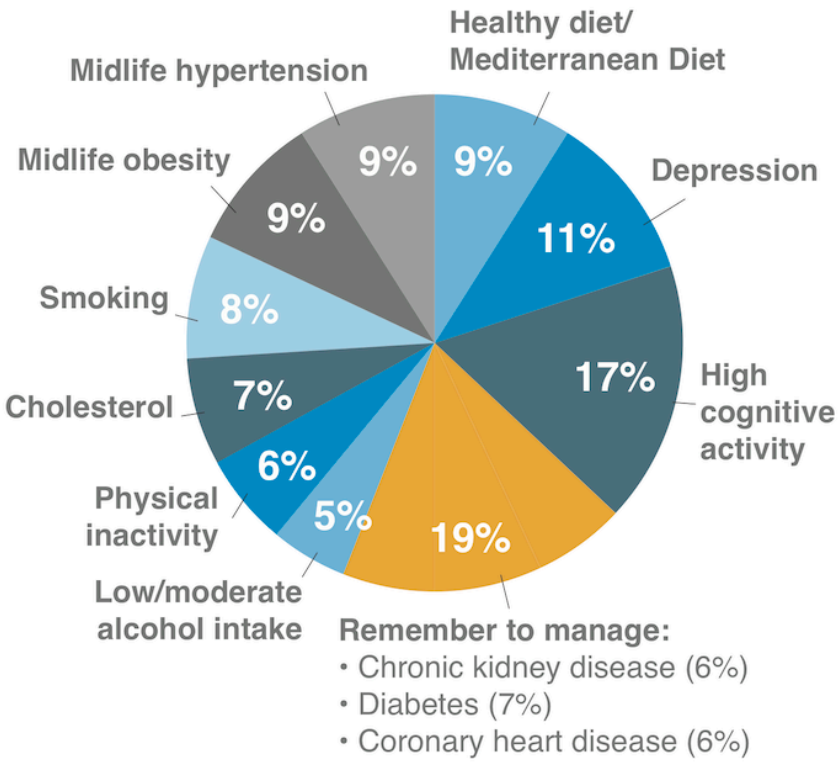
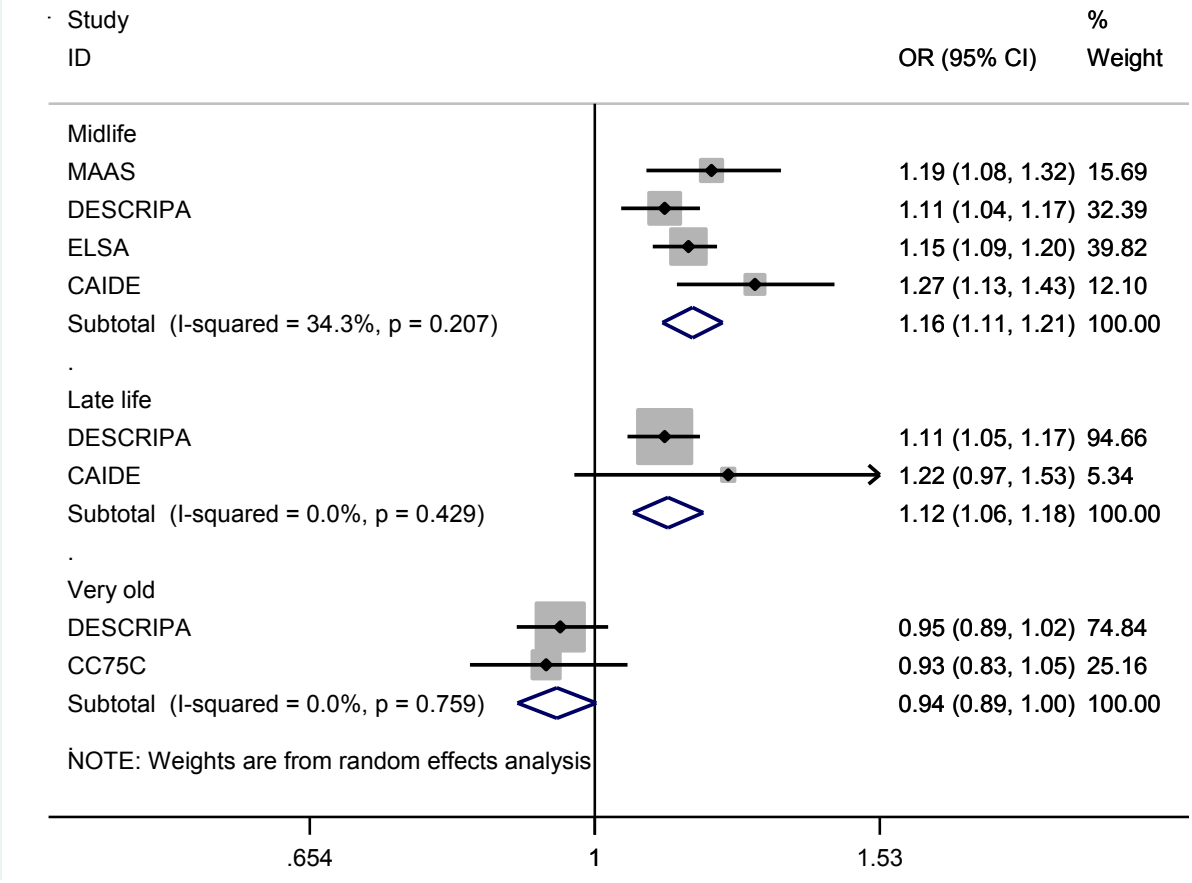


Figure showing results from an unpublished meta-analysis on the 5 prospective population-based studies using LIBRA, stratified by age of participants at baseline assessment of LIBRA (all studies adjusted for age, sex and educational level). The effect is shown of a one-point increase in LIBRA on odds for dementia.



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