**Supplementary information**

**Statistical methods**

The analysis first investigated the relationships between individual measures and living well outcomes using linear regression modelling and adjusting for age, sex and dementia subtypes. This was used to ensure directions and strengths of individual associations. Based on the five domains in the conceptual model (Supplementary Table 1), all variables identified within the same domain were fitted in one multivariate regression model adjusting for age, sex and subtypes. Based on the adjusted results, three selection criteria were applied to identify the important variables related to living well (Quality of Life in Alzheimer’s Disease scale (QoL-AD),1, 2 Satisfaction with Life Scale (SwLS),3 World Health Organization-Five Well-Being Index (WHO-5)4) and to simplify the model as much as possible:

1. Statistical significance: Wald test was used to examine whether the associations between living well outcomes and a specific measurement achieved statistical significance in the multivariate model.
2. Meaningful difference: The effect sizes were considered to be meaningful when unstandardised regression coefficients achieved QoL-AD>1.5 or SwLS>1.5 or WHO-5>5.0. These cut-offs were determined to balance the need for clinical relevance and based on the literature.5-7
3. Binary/ordinal variables: If there was a dose-response relationship, an ordinal model was used for the variable. Categorical variables were regrouped into binary variables if appropriate (given similar effect sizes at different levels).

After the selection process using multivariate modelling, structural equation modelling (SEM) was employed to generate a latent factor for selected variables within each domain and build a structural model examining the associations between individual latent factors and the living well latent with QoL-AD fixed at 1. The variances of individual latent factors were fixed at 1. The results of SEM for the five individual constructs are reported in Supplementary Table 2. A full model was fitted to include all five latent factors and adjusted for age, sex and dementia subtypes. To account for correlations between latent factors and stabilise estimates in the full model, two variables from the psychological characteristics and psychological health domain, attitude toward own ageing and depression, were found to also be important in the managing everyday life with dementia domain. To enable the model to reflect a positive perspective on ‘living well’ the scales of the three living well measures were reversed. The results of the full model are reported in Supplementary Table 3. Quasi-maximum likelihood estimation methods were used to estimate coefficients and appropriate confidence intervals for categorical/ordinal variables.

Multiple imputation (MI) was used to address missing data in selected variables and living well outcomes. A formal MI should impute all individual items within a scale.8 However, due to the combination of the complex model and the proportion of missing data, the formal MI approach could not be applied to the full model in a single attempt. To identify a reasonable method balancing efficiency and accuracy, MI was first conducted within each latent factor and missing variables were imputed by i) categories, ii) total scores and iii) individual items, using the method of multiple imputation by chained equations, and for continuous variables predictive mean matching. Age, sex and dementia subtypes were also included in the imputation model. If the SEM results were similar across different imputed datasets, the most efficient method (categories>total scores>individual items) was used for the full model. Estimates from 10 imputed datasets were combined using Rubin’s rules.8 Based on the results of imputed full model, changes in QoL-AD, SwLS and WHO-5 scores were estimated for per unit increase in the five latent factors. All analyses were conducted using Stata 14.0.9

Supplementary Table 1. Variables considered for inclusion under each domain

|  |  |
| --- | --- |
| Factor | Measure |
| Psychological Characteristics and Psychological Health (PSY) |
| Personality | Mini-IPIP10 |
| Religious belief | Single item11 |
| Spirituality | Single item  |
| Optimism | Life Orientation Test-Revised12 |
| Self-esteem | Rosenberg Self-Esteem Scale13; single item14 |
| Self-acceptance | Ryff Scales of Psychological Well-Being15 self-acceptance subscale16 |
| Self-efficacy | Generalized Self-Efficacy Scale17 |
| Continuity of sense of self | Single item |
| Loneliness | De Jong Gierveld Loneliness Scale18; single item |
| Depression | Geriatric Depression Scale-1019 |
| Stressful life events | Social Readjustment Rating Scale20 abbreviated 10-item version  |
| Attitudes towards own ageing | Philadelphia Geriatric Center Morale Scale21 |
| Subjective age | Single item |
| Experience of stigma | Stigma Impact Scale22, 23 abbreviated 4-item version |
| Physical Fitness and Health (PHY) |
| Physical activity | General Practice Physical Activity Questionnaire24 |
| Smoking | Current smoker/former smoker/never smoked |
| Alcohol consumption | Currently does/does not consume alcohol |
| Appetite | Short Nutritional Assessment Questionnaire25 |
| Eyesight | Single item16 |
| Hearing | Single item16 |
| Change in gustation | Single item26 |
| Change in olfaction | Single item26 |
| Sleep quality | Single item |
| Falls | Number of falls in past year16 |
| Co-morbid conditions | Charlson Co-morbidity Index27, 28 |
| Self-rated health | Single item29 |
| Social capitals, assets and resources (CAR) |
| Education  | Highest level of education achieved |
| Income  | Income adjusted for household size30 |
| Social capital | Resource Generator-UK31 |
| Cultural capital | Cultural Capital and Social Exclusion Survey32 |
| Social network | Lubben Social Network Scale33 |
| Personal relations | Office for National Statistics Social Capital Scale34  |
| Reciprocity and local trust  | Office for National Statistics Social Capital Scale34 |
| Social participation | Office for National Statistics Social Capital Scale34 |
| Civic participation | Office for National Statistics Social Capital Scale34 |
| Managing Everyday Life with Dementia (MEL) |
| Cognition | Addenbrooke’s Cognitive Examination-III35 |
| Functional ability | Functional Assessment Questionnaire amended 11-item version36, 37 |
| Dependence | Dependence Scale38 |
| Social Location (SLC) |
| Social class | Socio-economic status based on occupation39 |
| Social comparison | Single item |
| Social status  | MacArthur Scale of Subjective Social Status (social ladder 40 |
| Community status  | MacArthur Scale of Subjective Social Status (community ladder 40 |

Supplementary Table 2. Results of structural equation modelling for each of the five latent factors

1. Psychological characteristics and psychological health (PSY)

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Measurement: living well |  |  |
| QoL-AD | 1 (fixed) | 1 (fixed) |
| SwLS | 0.87 (0.81, 0.93) | 0.87 (0.81, 0.93) |
| WHO-5 | 3.19 (2.98, 3.40) | 3.18 (2.97, 3.39) |
|  |  |  |
| Measurement: psychological characteristics and health |
| Personality neuroticism |  |  |
|  Continuous score | 1.76 (1.56, 1.96) | 1.78 (1.58, 1.98) |
| Optimism |  |  |
|  Continuous score | -2.01 (-2.23, -1.80) | -2.00 (-2.22, -1.79) |
| Self-esteem |  |  |
|  Ordinal variable | -0.41 (-0.46, -0.36) | -0.41 (-0.46, -0.36) |
| Attitude toward own ageing |  |  |
|  Continuous score | -1.08 (-1.15, -1.01) | -1.07 (-1.15, -1.00) |
| Depression |  |  |
|  Yes vs no (ref) | 0.33 (0.31, 0.34) | 0.33 (0.31, 0.34) |
| Subjective age |  |  |
|  Ordinal variable | -0.17 (-0.22, -0.13) | -0.17 (-0.22, -0.13) |
| Loneliness |  |  |
|  Yes vs no (ref) | 0.10 (0.08, 0.13) | 0.10 (0.08, 0.13) |
|  |  |  |
| Structural  |  |  |
| PSY -> Living well | 4.86 (4.55, 5.17) | 4.86 (4.54, 5.18) |

*Note: Latent variance of psychological characteristics and health fixed at 1; Model 1: unadjusted; Model 2: adjusted for age, sex and subtypes.* *QoL-AD: Quality of Life in Alzheimer’s Disease scale; SwLS: Satisfaction with Life Scale; WHO-5: World Health Organization-Five Well-Being Index.*

(b) Physical fitness and health (PHY)

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Measurement: living well |  |  |
| QoL-AD | 1 (fixed) | 1 (fixed) |
| SwLS | 0.81 (0.75, 0.87) | 0.82 (0.76, 0.88) |
| WHO-5 | 3.18 (2.95, 3.42) | 3.19 (2.96, 3.43) |
|  |  |  |
| Measurement: Physical fitness and health |
| Poor sleep |  |  |
|  Ordinal variable | 0.50 (0.43, 0.57) | 0.51 (0.44, 0.58) |
| Poor eyesight |  |  |
| Ordinal variable | 0.50 (0.44, 0.56) | 0.50 (0.44, 0.56) |
| Poor hearing |  |  |
| Ordinal variable | 0.36 (0.29, 0.43) | 0.35 (0.28, 0.42) |
| Poor self-rated health |  |  |
| Ordinal variable | 0.69 (0.64, 0.75) | 0.70 (0.64, 0.75) |
| Poor appetite |  |  |
|  Binary variable | 0.15 (0.13, 0.18) | 0.15 (0.13, 0.18) |
| Smoking |  |  |
|  Ordinal variable | 0.12 (0.08, 0.15) | 0.11 (0.07, 0.15) |
| Change in olfaction |  |  |
|  Yes vs No (ref.) | 0.08 (0.06, 0.11) | 0.09 (0.06, 0.11) |
|  |  |  |
| PHY -> Living well | -4.29 (-4.64, -3.94) | -4.21 (-4.58, -3.84) |

*Note: Latent variance of physical fitness and health fixed at 1; Model 1: unadjusted; Model 2: adjusted for age, sex and subtypes.* *QoL-AD: Quality of Life in Alzheimer’s Disease scale; SwLS: Satisfaction with Life Scale; WHO-5: World Health Organization-Five Well-Being Index.*

(c) Social capitals, assets and resources (CAR)

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Measurement: living well |  |  |
| QoL-AD | 1 (fixed) | 1 (fixed) |
| SwLS | 0.84 (0.78, 0.91) | 0.85 (0.78, 0.92) |
| WHO-5 | 3.18 (2.93, 3.43) | 3.17 (2.93, 3.41) |
|  |  |  |
| Measurement: Social capitals, assets and resources |
| Social network |  |  |
|  Isolated vs not isolated (ref.) | -0.23 (-0.27, -0.18) | -0.22 (-0.26, -0.19) |
| Cultural capital |  |  |
|  Ordinal variable | 0.49 (0.40, 0.58) | 0.55 (0.46, 0.64) |
| Reciprocity and local trust  |  |  |
|  Not likely vs likely\* (ref.) | -0.15 (-0.18, -0.11) | -0.13 (-0.16, -0.09) |
|  |  |  |
| Structural  |  |  |
| CAR -> Living well | 2.69 (2.12, 3.27) | 2.83 (2.23, 3.44) |

*Note: Latent variance of social capitals, assets and resources fixed at 1; Model 1: unadjusted; Model 2: adjusted for age, sex and subtypes \*Likelihood of return of lost wallet. QoL-AD: Quality of Life in Alzheimer’s Disease scale; SwLS: Satisfaction with Life Scale; WHO-5: World Health Organization-Five Well-Being Index.*

(d) Managing everyday life with dementia (MEL)

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Measurement: living well |  |  |
| QoL-AD | 1 (fixed) | 1 (fixed) |
| SwLS | 0.82 (0.75, 0.88) | 0.83 (0.76, 0.89) |
| WHO-5 | 3.16 (2.90, 3.42) | 3.18 (2.93, 3.44) |
|  |  |  |
| Measurement: Managing everyday life |
| Functional ability |  |  |
|  Ordinal variable | 0.92 (0.83, 1.00) | 0.91 (0.82, 1.00) |
| Dependence |  |  |
| Ordinal variable | 0.89 (0.81, 0.96) | 0.89 (0.81, 0.97) |
|  |  |  |
| MEL -> Living well | -2.23 (-2.60, -1.86) | -1.98 (-2.35, -1.61) |

*Note: Latent variance of managing everyday life with dementia fixed at 1; Model 1: unadjusted; Model 2: adjusted for age, sex and subtypes. QoL-AD: Quality of Life in Alzheimer’s Disease scale; SwLS: Satisfaction with Life Scale; WHO-5: World Health Organization-Five Well-Being Index.*

(e) Social Location (SLC)

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Measurement: living well |  |  |
| QoL-AD | 1 (fixed) | 1 (fixed) |
| SwLS | 0.84 (0.78, 0.91) | 0.84 (0.78, 0.91) |
| WHO-5 | 3.16 (2.92, 3.41) | 3.16 (2.92, 3.41) |
|  |  |  |
| Measurement: Social location |  |
| Social comparison |  |  |
|  Ordinal variable | 0.50 (0.42, 0.59) | 0.54 (0.45, 0.63) |
| Community status |  |  |
|  Ordinal variable | 0.31 (0.26, 0.36) | 0.29 (0.24, 0.34) |
|  |  |  |
| Structural  |  |  |
| SLC -> Living well | 4.29 (3.64, 4.94) | 4.66 (3.60, 5.72) |

*Note: Latent variance of social location fixed at 1; Model 1: unadjusted; Model 2: adjusted for age, sex and subtypes. QoL-AD: Quality of Life in Alzheimer’s Disease scale; SwLS: Satisfaction with Life Scale; WHO-5: World Health Organization-Five Well-Being Index.*

Supplementary Table 3. Coefficients and confidence intervals for the complete model

|  |  |  |
| --- | --- | --- |
|  | Unadjusted | Adjusted for age, sex and dementia sub-type |
|  | Coef. | (95% CI) | Coef. | (95% CI) |
| Measurement model - living well  |  |  |
|  QoL-AD | 1 | (fixed) | 1 | (fixed) |
|  SwLS | 0.83 | (0.78, 0.88) | 0.83 | (0.78, 0.88) |
|  WHO-5 | 3.15 | (2.97, 3.33) | 3.14 | (2.96, 3.32) |
| Structural associations |  |  |
| PSY | 3.49 | (2.93, 4.05) | 3.55 | (2.93, 4.17) |
| SLC | -0.06 | (-1.34, 1.21) | 0.08 | (-2.10, 2.26) |
| MEL | 0.33 | (-0.06, 0.73) | 0.33 | (-0.06, 0.71) |
| PHY | 1.23 | (0.36, 2.11) | 1.23 | (-0.10, 2.58) |
| CAR | 0.58 | (0.13, 1.03) | 0.67 | (-0.04, 1.38) |
| Correlations between latent factors |  |  |
| PSY, SLC | -0.77 | (-0.88, -0.66) | -0.76 | (-0.87, -0.65) |
| PSY, MEL | 0.32 | (0.24, 0.41) | 0.31 | (0.23, 0.40) |
| PSY, PHY | 0.75 | (0.70, 0.80) | 0.75 | (0.70, 0.80) |
| PSY, CAR | 0.41 | (0.31, 0.52) | 0.39 | (0.29, 0.50) |
| SLC, MEL | -0.43 | (-0.53, -0.33) | -0.42 | (-0.52, -0.32) |
| SLC, PHY | -0.84 | (-0.95, -0.73) | -0.83 | (-0.94, -0.72) |
| SLC, CAR | -0.52 | (-0.68, -0.36) | -0.48 | (-0.64, -0.32) |
| MEL, PHY | 0.41 | (0.34, 0.47) | 0.41 | (0.35, 0.47) |
| MEL, CAR | 0.38 | (0.27, 0.48) | 0.37 | (0.27, 0.47) |
| PHY, CAR | 0.40 | (0.30, 0.50) | 0.39 | (0.29, 0.48) |

*Note: QoL-AD: Quality of Life in Alzheimer’s Disease scale; SwLS: Satisfaction with Life Scale; WHO-5: World Health Organization-Five Well-Being Index; SLC: Social Location; CAR: Social capitals, assets and resources; PSY: Psychological Characteristics and Psychological Health; PHY: Physical Fitness and Health; MEL: Managing Everyday Life with Dementia*

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