# Supplementary Online Content

Chen M, Hanewald K, Si Y, Gu Y, Beard JR. Intrinsic capacity across 15 countries in the Survey of Health, Aging, and Retirement in Europe. *JAMA Netw Open.* 2025;8(5):e259792. doi:10.1001/jamanetworkopen.2025.9792



This supplementary material has been provided by the authors to give readers additional information about their work.

# **eAppendix 1.** Measures

We note that in SHARE Wave 6, the Netherlands did not participate in the regular SHARE wave but conducted an experiment using an online survey (CAWI) or telephone interviewing (CATI) instead of face-to-face interviews (CAPI) as conducted in the rest of the SHARE Wave 6 countries, as described here: https://share-eric.eu/data/data-set-details/dutch-mixed-mode-experiment-w6-1).

## Psychological

Affect: Affect was measured by the EURO-D scale within the SHARE dataset,[2] with eight specific variables (i.e., depression, pessimism, suicidality, guilt, lack of interest, irritability, lack of enjoyment, and tearfulness) designated as indicators of depressed mood. Each item was scored using a binary system, with a score of 1 assigned to the absence of the corresponding symptom and 0 assigned to its presence. The overall affect score was then calculated as the sum of the eight designated items, with higher scores indicating better affect.

Sleep: Self-reported sleep quality was evaluated using a simple dichotomous measure. Specifically, participants were asked to indicate whether they had experienced any difficulties with sleeping recently. The available response options included two categories, namely "no trouble sleeping" (scored as 1) and "trouble with sleep" (scored as 0).

Concentration: Concentration was assessed through the use of two self-reported items: concentration on entertainment and concentration on reading. Each item was scored dichotomously, with participants indicating whether they experienced any difficulties with concentration using the response options "no trouble concentrating" (scored as 1) and "having trouble concentrating" (scored as 0). To determine the overall concentration score, the responses to the two items were summed, with higher scores indicating better concentration.

## Cognitive

Memory: Memory was assessed through self-report, with participants indicating their perceived level of memory using a five-point scale. Responses were categorised as poor (scored as 0), fair (scored as 1), good (scored as 2), very good (scored as 3), or excellent (scored as 4).

Verbal fluency: Verbal fluency was assessed by asking participants to verbally list as many animals as possible within a designated time frame of one minute. The corresponding score for this item was calculated based on the number of animals that were correctly named within the given time limit. In general, higher scores on this task indicate better verbal fluency.

Math: Math ability was assessed by instructing participants to perform a subtraction of 7 from 100, and to repeat this process five times in a row. The corresponding score for this item was calculated based on the number of correctly answered questions, with scores ranging from 0 to 5. Higher scores on this task are indicative of better math ability.

Recall: There are two items used to calculate recall function in SHARE Wave 5. The first one is the instant recall test: participants were asked to repeat words immediately after they heard from the examiner. The second one is delayed recall: participants were asked to repeat words they heard a while ago.

## Sensory

Eyesight: Self-assessment was used to evaluate both distant and near eyesight. Participants were asked to rate their eyesight on a scale of five responses: poor, fair, good, very good, and excellent, which were scored as 0, 1, 2, 3, and 4, respectively. A higher score indicates better eyesight.

Hearing: Self-assessment was used to evaluate hearing ability, with responses rated on a scale of five levels: poor, fair, good, very good, and excellent, which were scored as 0, 1, 2, 3, and 4, respectively. A higher score indicates better hearing.

### Locomotor

Chair stand: The chair stand test was performed once per participant. Participants were asked to fold their arms across their chests, stand up from a seated position on a chair and sit down again five times. The time (in seconds) taken for the participant to stand up five times without using their hands was measured using a stopwatch. Results were categorised into five levels according to ICOPE: less than 11.19 seconds (scored as 4), 11.2-13.69 seconds (scored as 3), 13.7-16.69 seconds (scored as 2), 16.7-59.9 seconds (scored as 1), and greater than 60 seconds (scored as 0).

Mobility: Participants were asked to report any difficulty they experienced when performing everyday mobility-related activities during the assessment. The activities included walking 100 metres, sitting for about two hours, getting up from a chair after sitting for long periods, climbing several flights of stairs without resting, climbing one flight of stairs without resting, stooping, kneeling, or crouching, reaching or extending arms above shoulder level, pulling or pushing large objects like a living room chair, lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries, and picking up a small coin from a table. Participants were asked to indicate the number of activities that they found difficult, and a score was calculated by subtracting the number of difficult activities from 10. Therefore, higher scores indicated better mobility.

### Vitality

Grip strength: Grip strength was measured using a handheld dynamometer (Smedley, S Dynamometer, TTM, Tokyo, 100 kg) on each hand. Two measurements were taken on each hand, alternating between the hands. The score was determined by the maximum grip strength recorded from either hand.

BMI: The body mass index (BMI) was calculated for all participants using their recorded weight and height. The BMI score was categorised into three levels: a BMI of less than 18.5 or greater than or equal to 30 was scored as 0, a BMI between 18.5 and 25 was scored as 2, and a BMI between 25 and 30 was scored as 1. Higher scores indicate a healthier BMI.

Weight loss: The participants were asked to report the amount of weight they had lost within the past six months. Their answers were categorised into three levels: no weight loss or less than 1 kg (scored as 2), 1-3 kg (scored as 1), and more than 3 kg (scored as 0).

### Covariates

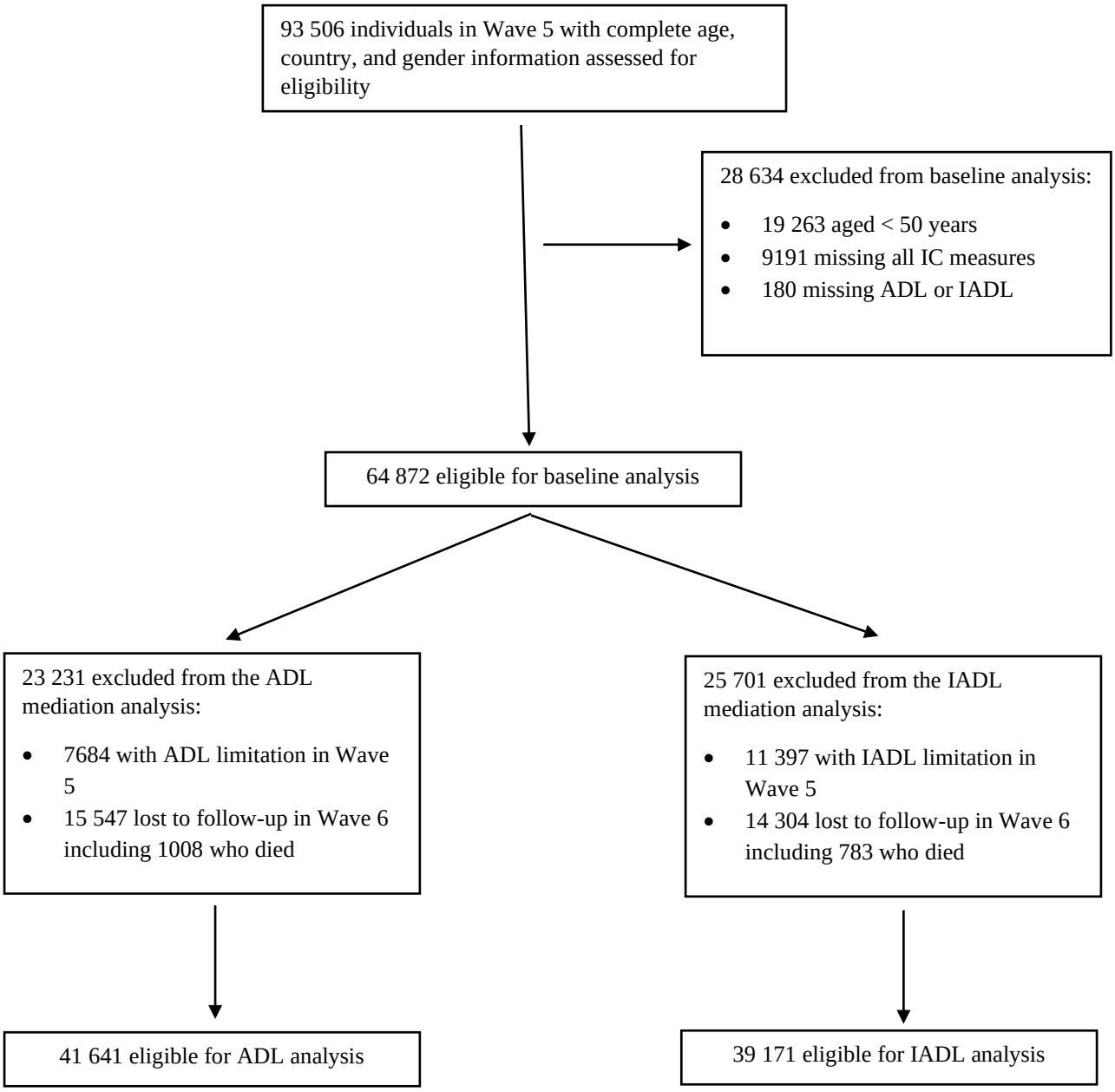
Multimorbidity: heart attack, high blood pressure, high blood cholesterol, stroke or cerebral vascular disease, diabetes or high blood sugar, chronic lung disease, cancer or malignant tumour (excluding minor skin cancers), stomach or duodenal ulcer, Parkinson's disease, cataracts, hip fracture, other fractures, Alzheimer's disease, dementia, organic brain syndrome, memory impairment, affective or emotional disorders, rheumatoid arthritis, osteoarthritis, or other rheumatism.[1]

**eTable 1.** Sample Characteristics by Country

| Country | Women (%) | Age (SD) | Education (%) | | | Multimorbidity (%) | | | ADL (SD) | IADL (SD) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Level 1 | Level 2 | Level 3 | 0 | 1 or 2 | 3 or more | | |
| Austria | 57.412 | 67.477 (9.679) | 23.570 | 48.546 | 25.953 | 24.976 | 52.264 | 21.902 | 0.243 (0.89) | 0.443 (1.244) |
| Belgium | 54.935 | 66.245 (10.633) | 37.708 | 26.157 | 32.719 | 21.782 | 51.898 | 26.302 | 0.31 (0.915) | 0.446 (1.173) |
| Czech Republic | 58.359 | 67.061 (9.04) | 38.924 | 46.441 | 12.842 | 16.320 | 49.683 | 33.871 | 0.275 (0.883) | 0.414 (1.141) |
| Denmark | 53.539 | 65.407 (10.127) | 19.038 | 38.175 | 41.751 | 24.908 | 49.840 | 25.228 | 0.179 (0.717) | 0.309 (1.021) |
| Estonia | 60.296 | 68.451 (9.722) | 29.699 | 48.758 | 21.402 | 19.605 | 51.488 | 28.818 | 0.39 (1.042) | 0.577 (1.336) |
| France | 56.955 | 67.907 (10.411) | 32.556 | 34.685 | 20.344 | 22.202 | 52.855 | 24.898 | 0.265 (0.868) | 0.414 (1.165) |
| Germany | 52.351 | 65.125 (10.008) | 12.301 | 56.982 | 29.233 | 18.505 | 51.010 | 30.377 | 0.232 (0.832) | 0.314 (1.015) |
| Israel | 55.730 | 68.048 (10.209) | 26.334 | 30.573 | 32.457 | 23.312 | 40.188 | 36.028 | 0.451 (1.326) | 0.872 (1.778) |
| Italy | 54.374 | 67.286 (9.914) | 61.552 | 20.138 | 7.995 | 24.973 | 49.860 | 25.102 | 0.347 (1.136) | 0.479 (1.42) |
| Luxembourg | 52.871 | 64.738 (9.827) | 44.479 | 34.196 | 18.549 | 14.196 | 47.950 | 37.855 | 0.249 (0.851) | 0.373 (1.124) |
| Netherlands | 55.089 | 66.467 (9.709) | 44.596 | 25.043 | 26.864 | 27.812 | 51.931 | 20.233 | 0.153 (0.681) | 0.292 (0.928) |
| Slovenia | 56.653 | 67.019 (10.031) | 29.012 | 48.320 | 17.044 | 23.731 | 52.846 | 23.422 | 0.219 (0.838) | 0.369 (1.147) |
| Spain | 53.741 | 68.665 (10.901) | 53.573 | 9.950 | 9.874 | 19.351 | 50.312 | 30.321 | 0.379 (1.204) | 0.64 (1.598) |
| Sweden | 53.295 | 68.528 (9.346) | 34.546 | 32.505 | 29.732 | 21.877 | 53.162 | 24.917 | 0.167 (0.713) | 0.249 (0.894) |
| Switzerland | 54.524 | 67.055 (9.746) | 19.499 | 62.137 | 16.394 | 35.927 | 49.449 | 14.624 | 0.096 (0.482) | 0.156 (0.611) |

*Notes:* ADL: Activities of Daily Living; IADL: Instrumental Activities of Daily Living; SD: Standard Deviation. Sample size N = 64,872 (Women: 35 976; Men: 28 896). Missing value percentage: Education (6.3%) and Multimorbidity (0.1%). All the other variables are complete.

**eFigure 1.** Flowchart: Study Inclusion Criteria




*Notes:* ADL: Activities of Daily Living; IADL: Instrumental Activities of Daily Living.

# **eAppendix 2.** Statistical Analysis

## Validation

We used Confirmatory Factor Analysis (CFA), Exploratory Structural Equation Modelling (ESEM) framework, bifactor CFA, bifactor ESEM, and path analysis to assess the validity of IC. A range of statistical measures were used to evaluate the goodness-of-fit of these models. These included the absolute fit index Chi-Square (χ^2), the approximate fit index root means square error of approximation (RMSEA), and the incremental fit indices, including the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). The Weighted Least Square Mean and Variance Adjusted (WLSMV) estimator, with robust standard errors and adjusted mean and variance, was used to assess the ESEM, CFA, and bifactor models. We assumed the missing data mechanism to be missing at random and applied pairwise deletion to handle missing data.

A series of ESEM models with varying numbers of factors as well as a bifactor ESEM were performed. The bifactor model was chosen to investigate the presence of a general IC factor with five subfactors. To evaluate the goodness-of-fit of these models, we employed a range of statistical measures. These included the absolute fit index Chi-Square (χ^2), the approximate fit index root means square error of approximation (RMSEA), and the incremental fit indices, including the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI).

After exploring the potential structure of IC as one general factor with five subfactors, we further employed a series of CFA models to test the structure. These models included a single-factor model, a correlated five-factor model, a hierarchical (second-order) model, and a bifactor model. The CFA models were assessed using the same model fit statistics as previously described. The Weighted Least Square Mean and Variance Adjusted (WLSMV) estimator, with robust standard errors and adjusted mean and variance, was used to assess the ESEM, CFA, and bifactor models. We assumed the missing data mechanism to be missing at random and applied pairwise deletion to handle missing data.

Subsequently, we tested the construct and predictive validity of IC. Factor scores were extracted from the hierarchical CFA model using the empirical Bayes method. These factor scores have a mean of zero and a standard deviation of one. To test the construct validity, we ran a linear regression to investigate the relationship between IC factor scores and personal characteristics, including age, gender, education, income, and multimorbidity. The country location of each individual was controlled for in these regressions to account for potential unobserved confounding effects.

To test the predictive validity, we employed mediation analysis to explore the potential pathways of the relationship between baseline IC in Wave 5 (2013) and the declining performance in Wave 6 (2015). We conducted these analyses separately for ADL and IADL. Initially, we selected participants with no performance limitations (scoring 0 in ADL or IADL) in Wave 5, and then extracted their ADL or IADL scores in Wave 6. Participants who developed performance limitations in Wave 6 were assigned a score of 1, while those without limitations retained a score of 0.

We ran a mediation model to examine the direct effects of IC on declining performance in ADL and IADL, as well as the indirect effects through multimorbidity, while controlling for possible confounders (i.e., age, gender, education, income, and country). Parameter estimation was performed using the robust WLSMV estimator. Subsequently, we applied a multi-level serial multiple mediators model to investigate the influence of personal characteristics (i.e., age, gender, education, and income) from Wave 5 on subsequent performance declines in ADL and IADL in Wave 6 while controlling for countries. This method accounts for the nested data structure, where individuals are

grouped within countries. We adopted the 1-1-1 design of two-level mediation analysis to accommodate this nested structure and ensure accuracy in our analysis. In this model, variables including personal characteristics (age, gender, education, and income), IC, multimorbidity, ADL, and IADL are considered as collected at the individual level (level 1). Meanwhile, the model allows the regression slopes (i.e., the relationships between variables) to differ across countries (level 2). As a result, the model accounts for potential country-specific variations in our data. This flexibility provides a more nuanced understanding of the complex relationships between personal characteristics and health conditions while considering the differences in the countries in which individuals reside.

### Cross-country comparisons

The calibrated weights in SHARE were calculated following the methodology proposed by Deville and Särndal.[3]

### Centile Curves

We treated age as a continuous variable and assumed IC and subdomains followed a specific distribution selected from a range of distributions, including Box-Cox Cole and Green (BCCG), Box-Cox t (BCT), and Box-Cox Power Exponential (BCPE). In the BCCG case, GAMLSS reduces to the LMS method, which is also widely used for modelling centile curves.[4]

To select the best distribution, we used model selection metrics such as the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), along with diagnostic statistics, including worm plots and Q statistics. AIC and BIC were used to compare model fit, while worm plots and Q statistics helped detect inadequacies both globally and locally. The smoothing method employed in our model is the P-splines method,[5] and the smoothing parameters (hyperparameters) were automatically tuned using build-in functions in the gamlss package in R.

# eAppendix 3: Results

## Validation

**eTable 2.** Model Fit Statistics of ESEM and CFA Models and Construct validity of IC and Subdomain Scores

Model Fit Statistics of ESEM and CFA Models

| **Models** | **Model fit statistics** | | | | |
|---|---|---|---|---|---|
| | **$\chi^2$** | **df** | **CFI** | **TLI** | **RMSEA (90% CI)** |
| **ESEM** | | | | | |
| One-factor | 91 305.539 | 104 | 0.888 | 0.870 | 0.116 (0.116, 0.117) |
| Two-factors | 28 984.489 | 89 | 0.964 | 0.952 | 0.071 (0.070, 0.071) |
| Three-factors | 9486.583 | 75 | 0.988 | 0.981 | 0.044 (0.043, 0.045) |
| Four-factors | 5418.368 | 62 | 0.993 | 0.987 | 0.036 (0.036, 0.037) |
| Five-factors | 3212.744 | 50 | 0.996 | 0.991 | 0.031 (0.030, 0.032) |
| Bifactor (one general factor and five sub-factors)[1] | 2427.504 | 34 | 0.997 | 0.990 | 0.033 (0.032, 0.034) |
| **CFA** | | | | | |
| One-factor | 91 305.539 | 104 | 0.888 | 0.870 | 0.116 (0.116, 0.117) |
| Second-factor | 35 428.928 | 99 | 0.956 | 0.947 | 0.074 (0.074, 0.075) |
| Correlated five factors | 32 545.787 | 94 | 0.960 | 0.949 | 0.073 (0.072, 0.074) |
| Bifactor (one general factor and five sub-factors) | 11 317.921 | 89 | 0.986 | 0.981 | 0.044 (0.043, 0.045) |

*Note:* [1]Bifactor exploratory analysis is conducted in the Exploratory Structural Equation Modelling (ESEM) framework. **$\chi^2$**= Chi-square, **df** = degree of freedom, **CFI** = comparative fit index, **TLI** = Tucker–Lewis index, **RMSEA** =root mean square error of approximation, **CI** = confidence interval.

Construct validity of IC and Subdomain Scores

| | **Intrinsic Capacity** | **Psychological** | **Cognitive** | **Sensory** | **Locomotor** | **Vitality** |
|---|---|---|---|---|---|---|
| | Coefficient (95% CI) | Coefficient (95% CI) | Coefficient (95% CI) | Coefficient (95% CI) | Coefficient (95% CI) | Coefficient (95% CI) |
| **Gender** | | | | | | |
| Men | Ref | Ref | Ref | Ref | Ref | Ref |
| | | | | | | |
| Women | -0·087 *** | -0·268 *** | 0·210 *** | -0·026 ** | -0·333 *** | -0·041 *** |
| | [-0·099, -0·074] | [-0·288, -0·248] | [0·192, 0·228] | [-0·044, -0·008] | [-0·357, -0·310] | [-0·062, -0·020] |
| **Age** | | | | | | |
| 50 ~ 59 | Ref | Ref | Ref | Ref | Ref | Ref |
| | | | | | | |
| 60 ~ 69 | -0·083 *** | 0·071 *** | -0·266 *** | -0·073 *** | -0·144 *** | -0·086 *** |
| | [-0·099, -0·067] | [0·045, 0·096] | [-0·290, -0·243] | [-0·096, -0·050] | [-0·174, -0·114] | [-0·113, -0·060] |
| 70 ~ 79 | -0·324 *** | -0·074 *** | -0·759 *** | -0·316 *** | -0·618 *** | -0·267 *** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | [-0·342, -0·306] | [-0·102, -0·045] | [-0·785, -0·733] | [-0·342, -0·290] | [-0·652, -0·584] | [-0·297, -0·237] |
| >= 80 | -0·889 *** | -0·531 *** | -1·591 *** | -0·852 *** | -1·825 *** | -0·750 *** |
| | [-0·911, -0·867] | [-0·566, -0·495] | [-1·623, -1·559] | [-0·884, -0·820] | [-1·867, -1·783] | [-0·787, -0·713] |
| **Education** | | | | | | |
| No education | Ref | Ref | Ref | Ref | Ref | Ref |
| | | | | | | |
| Intermediate | 0·268 *** | 0·237 *** | 0·499 *** | 0·186 *** | 0·430 *** | 0·379 *** |
| | [0·252, 0·283] | [0·212, 0·262] | [0·476, 0·521] | [0·164, 0·209] | [0·401, 0·460] | [0·353, 0·405] |
| Higher education | 0·476 *** | 0·420 *** | 0·938 *** | 0·326 *** | 0·710 *** | 0·729 *** |
| | [0·458, 0·494] | [0·392, 0·449] | [0·912, 0·963] | [0·300, 0·352] | [0·676, 0·744] | [0·699, 0·758] |
| **Income** | | | | | | |
| 1st quartile | Ref | Ref | Ref | Ref | Ref | Ref |
| | | | | | | |
| 2nd quartile | 0·138 *** | 0·151 *** | 0·187 *** | 0·112 *** | 0·273 *** | 0·184 *** |
| | [0·121, 0·156] | [0·123, 0·179] | [0·162, 0·213] | [0·087, 0·138] | [0·239, 0·306] | [0·155, 0·213] |
| 3rd quartile | 0·205 *** | 0·214 *** | 0·270 *** | 0·192 *** | 0·387 *** | 0·266 *** |
| | [0·187, 0·222] | [0·186, 0·242] | [0·244, 0·295] | [0·166, 0·217] | [0·354, 0·421] | [0·237, 0·296] |
| 4th quartile | 0·230 *** | 0·219 *** | 0·323 *** | 0·239 *** | 0·404 *** | 0·314 *** |
| | [0·212, 0·248] | [0·189, 0·248] | [0·297, 0·349] | [0·212, 0·265] | [0·370, 0·439] | [0·284, 0·345] |
| **Country** | | | | | | |
| Austria | Ref | Ref | Ref | Ref | Ref | Ref |
| | | | | | | |
| Belgium | -0·113 *** | -0·378 *** | -0·333 *** | 0·049 * | -0·030 | -0·118 *** |
| | [-0·145, -0·081] | [-0·429, -0·327] | [-0·378, -0·287] | [0·003, 0·096] | [-0·090, 0·031] | [-0·171, -0·065] |
| Czech Republic | -0·135 *** | -0·202 *** | -0·279 *** | -0·289 *** | -0·020 | -0·253 *** |
| | [-0·167, -0·104] | [-0·253, -0·151] | [-0·325, -0·233] | [-0·335, -0·243] | [-0·080, 0·040] | [-0·306, -0·200] |
| Denmark | 0·238 *** | 0·187 *** | -0·123 *** | 0·669 *** | 0·527 *** | 0·322 *** |
| | [0·204, 0·272] | [0·133, 0·242] | [-0·172, -0·074] | [0·620, 0·718] | [0·463, 0·592] | [0·265, 0·378] |
| Estonia | -0·404 *** | -0·499 *** | -0·541 *** | -0·630 *** | -0·546 *** | -0·543 *** |
| | [-0·435, -0·373] | [-0·549, -0·449] | [-0·586, -0·496] | [-0·676, -0·585] | [-0·605, -0·487] | [-0·595, -0·491] |
| France | -0·122 *** | -0·508 *** | -0·435 *** | 0·101 *** | 0·036 | -0·086 ** |
| | [-0·157, -0·088] | [-0·562, -0·453] | [-0·485, -0·386] | [0·052, 0·151] | [-0·029, 0·101] | [-0·143, -0·029] |
| Germany | -0·074 *** | -0·286 *** | -0·363 *** | 0·007 | 0·084 ** | -0·037 |
| | [-0·105, -0·042] | [-0·337, -0·235] | [-0·409, -0·318] | [-0·039, 0·053] | [0·024, 0·143] | [-0·089, 0·015] |
| Israel | -0·283 *** | -0·274 *** | -0·767 *** | -0·339 *** | -0·189 *** | -0·317 *** |
| | [-0·323, -0·243] | [-0·338, -0·210] | [-0·825, -0·710] | [-0·397, -0·281] | [-0·265, -0·114] | [-0·383, -0·251] |
| Italy | -0·419 *** | -0·753 *** | -0·893 *** | -0·613 *** | -0·405 *** | -0·315 *** |
| | [-0·453, -0·385] | [-0·807, -0·698] | [-0·942, -0·844] | [-0·663, -0·564] | [-0·470, -0·340] | [-0·371, -0·258] |
| Luxembourg | -0·053 * | -0·248 *** | -0·384 *** | 0·168 *** | 0·115 ** | -0·073 |
| | [-0·099, -0·007] | [-0·321, -0·175] | [-0·450, -0·318] | [0·101, 0·234] | [0·028, 0·202] | [-0·149, 0·003] |
| Netherlands | -0·014 | -0·125 *** | -0·201 *** | -0·126 *** | 0·185 *** | 0·043 |
| | [-0·048, 0·020] | [-0·179, -0·070] | [-0·250, -0·151] | [-0·175, -0·076] | [0·120, 0·249] | [-0·014, 0·100] |
| Slovenia | -0·265 *** | -0·293 *** | -0·600 *** | -0·313 *** | -0·264 *** | -0·374 *** |
| | [-0·303, -0·228] | [-0·353, -0·232] | [-0·654, -0·546] | [-0·368, -0·259] | [-0·335, -0·192] | [-0·436, -0·312] |
| Spain | -0·322 *** | -0·263 *** | -1·003 *** | -0·544 *** | -0·196 *** | -0·295 *** |
| | [-0·355, -0·289] | [-0·316, -0·210] | [-1·051, -0·955] | [-0·592, -0·496] | [-0·259, -0·133] | [-0·350, -0·239] |
| Sweden | 0·124 *** | -0·102 *** | -0·210 *** | 0·476 *** | 0·429 *** | 0·159 *** |
| | [0·091, 0·158] | [-0·155, -0·049] | [-0·258, -0·163] | [0·428, 0·524] | [0·366, 0·492] | [0·103, 0·214] |
| Switzerland | 0·157 *** | -0·055 | 0·011 | 0·010 | 0·474 *** | 0·241 *** |
| | [0·120, 0·194] | [-0·114, 0·004] | [-0·042, 0·065] | [-0·043, 0·064] | [0·404, 0·545] | [0·179, 0·302] |
| **Multimorbidity** | | | | | | |
| 0 | Ref | Ref | Ref | Ref | Ref | Ref |
| | | | | | | |
| 1 or 2 | -0·289 *** | -0·398 *** | -0·133 *** | -0·176 *** | -0·562 *** | -0·566 *** |
| | [-0·305, -0·273] | [-0·423, -0·372] | [-0·156, -0·110] | [-0·199, -0·153] | [-0·592, -0·532] | [-0·592, -0·539] |
| 3 or more | -0·770 *** | -0·908 *** | -0·337 *** | -0·485 *** | -1·642 *** | -1·330 *** |
| | [-0·789, -0·751] | [-0·938, -0·877] | [-0·364, -0·310] | [-0·512, -0·458] | [-1·678, -1·606] | [-1·361, -1·299] |
| $R^2$ | 0·365 | 0·174 | 0·359 | 0·216 | 0·374 | 0·268 |
| *** p < 0·001; ** p < 0·01; * p < 0·05. | | | | | | |

*Notes:* *** p < 0.001; ** p < 0.01; * p < 0.05. Sample size N = 64 872. Missing value percentage: Education (6.3%), Income (1.0%), and Multimorbidity (0.1%). All the other variables are complete. Controlled for country. Austria was selected as the reference country based on an alphabetically sorted list.

**eTable 3.** Comparison of Sample Characteristics Between Participants Included in the Mediation Analysis and Those Lost to Follow-Up Between Wave 5 and Wave 6

**a.** Mediation analysis for ADL (N = 41 641).

| Characteristics | | Mediation analysis | Lost to follow-up |
|---|---|---|---|
| **Women (%)** | | 55.77 | 52.70 |
| **Age (SD)** | | 66.29 (9.35) | 66.04 (9.98) |
| **Education (%)** | Lower | 33.92 | 37.78 |
| | Intermediate | 40.60 | 37.42 |
| | Higher | 25.48 | 24.80 |
| **Multimorbidity (%)** | 0 | 24.10 | 26.70 |
| | 1 or 2 | 52.73 | 51.38 |
| | 3 or more | 23.17 | 21.92 |

**b.** Mediation analysis for IADL (N = 39 171).

| Characteristics | | Mediation analysis | Lost to follow-up |
|---|---|---|---|
| **Women (%)** | | 54.22 | 51.02 |
| **Age (SD)** | | 65.81 (9.06) | 65.32 (9.51) |
| **Education (%)** | Lower | 32.47 | 36.50 |
| | Intermediate | 41.32 | 38.11 |
| | Higher | 26.21 | 25.38 |
| **Multimorbidity (%)** | 0 | 25.23 | 28.38 |
| | 1 or 2 | 53.35 | 51.80 |
| | 3 or more | 21.42 | 19.82 |

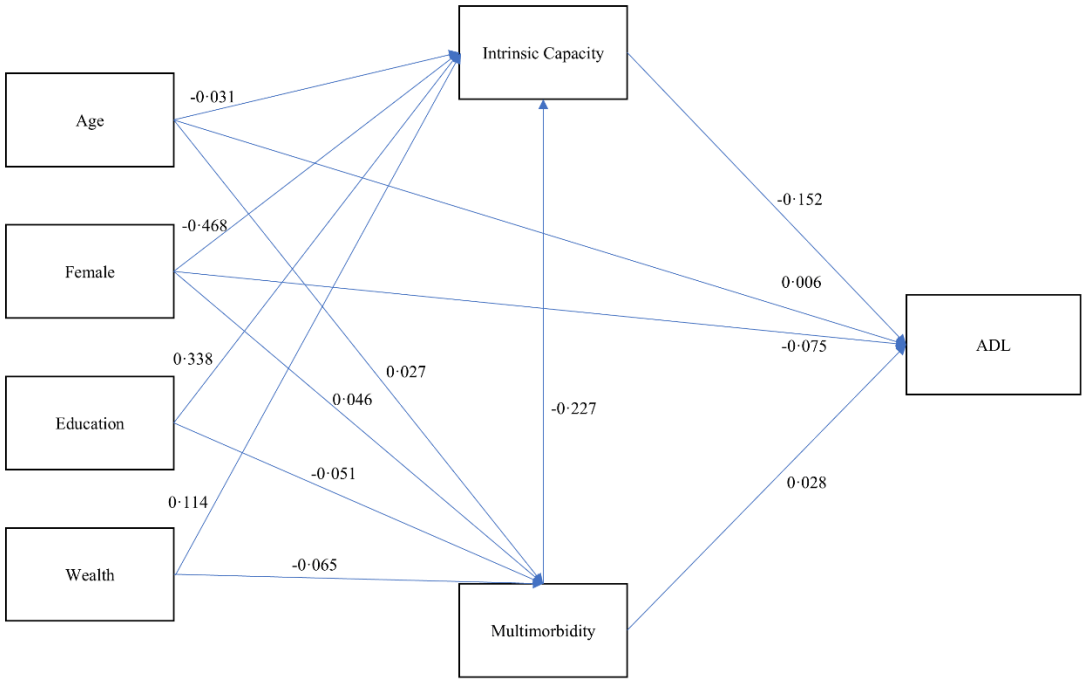
*Notes:* ADL: Activities of Daily Living; IADL: Instrumental Activities of Daily Living.

**eTable 4.** Regression Coefficients for the Direct Effects of IC on ADLs and IADLs, and Indirect Effects Through Multimorbidity

| Causal path | ADLs (N = 41 641) | | IADLs (N = 39 171) | |
|---|---|---|---|---|
| | Standardised coefficient | p-value | Standardised coefficient | p-value |
| **Total effect** | | | | |
| Intrinsic capacity | -0.155 | 0.000 | -0.239 | 0.000 |
| **Direct effect** | | | | |
| Intrinsic capacity | -0.148 | 0.000 | -0.231 | 0.000 |
| **Indirect effect** | | | | |
| Intrinsic capacity → multimorbidity | -0.007 | 0.000 | -0.007 | 0.000 |

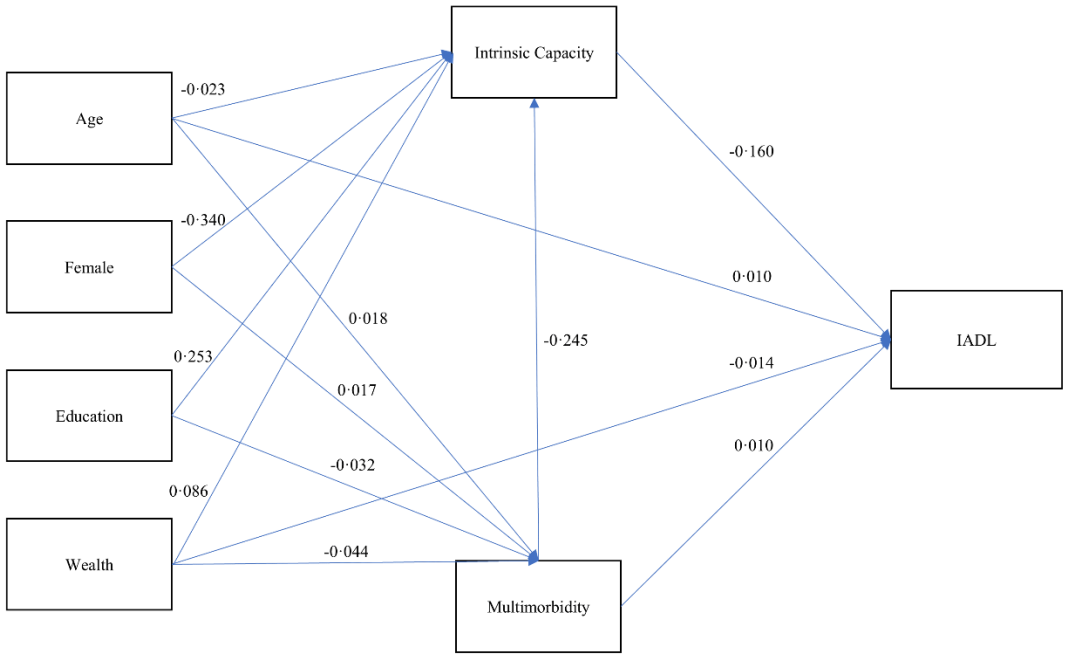
*Note:* Controlled for age, gender, education, income, and country.

**eFigure 2.** Direct and Indirect Effects of Personal Characteristics on ADL




*Note:* ADL denotes activities of daily living.

**eFigure 3.** Direct and Indirect Effects of Personal Characteristics on IADL




*Note:* IADL denotes instrumental activities of daily living.

**eTable 5.** Direct and Indirect Effects of Personal Characteristics on ADL and IADL Through Mediators (IC and Multimorbidity)

| | ADLs (N = 41 641) | | IADLs (N = 39 171) | |
|---|---|---|---|---|
| **Causal Path** | **Standardised coefficient (SE)** | **p-value** | **Standardised coefficient (SE)** | **p-value** |
| **Direct effect** | | | | |
| Age | 0.095 (0.000) | 0.000 | 0.148 (0.000) | 0.000 |
| Gender (women) | -0.007 (0.002) | 0.132 | 0.044 (0.003) | 0.000 |
| Education | 0.004 (0.002) | 0.476 | -0.012 (0.002) | 0.024 |
| Income | -0.010 (0.001) | 0.035 | -0.000 (0.002) | 0.999 |
| Multimorbidity | 0.039 (0.002) | 0.000 | 0.041 (0.002) | 0.000 |
| Intrinsic capacity | -0.213 (0.002) | 0.000 | -0.209 (0.002) | 0.000 |
| **Specific indirect effect** | | | | |
| Age → IC | 0.056 (0.000) | 0.000 | 0.050 (0.000) | 0.000 |
| Gender → IC | 0.016 (0.001) | 0.000 | 0.011 (0.001) | 0.000 |
| Education → IC | -0.049 (0.001) | 0.000 | -0.047 (0.001) | 0.000 |
| Income → IC | -0.016 (0.000) | 0.000 | -0.015 (0.000) | 0.000 |
| Age → multimorbidity | 0.010 (0.000) | 0.000 | 0.010 (0.000) | 0.000 |
| Gender → multimorbidity | 0.001 (0.000) | 0.000 | 0.001 (0.000) | 0.000 |
| Education → multimorbidity | -0.002 (0.000) | 0.000 | -0.002 (0.000) | 0.000 |
| Income → multimorbidity | -0.002 (0.000) | 0.000 | -0.002 (0.000) | 0.000 |
| **Indirect effect** | | | | |
| Age → multimorbidity → IC | 0.015 (0.000) | 0.000 | 0.014 (0.000) | 0.000 |
| Gender → multimorbidity → IC | 0.002 (0.000) | 0.000 | 0.001 (0.000) | 0.000 |
| Education → multimorbidity → IC | -0.003 (0.000) | 0.000 | -0.003 (0.000) | 0.000 |
| Income → multimorbidity → IC | -0.003 (0.000) | 0.000 | -0.003 (0.000) | 0.000 |

*Notes*: Adjusted for countries through two-level serial mediation analysis. SE denotes standard error.

## Analysis of IC values

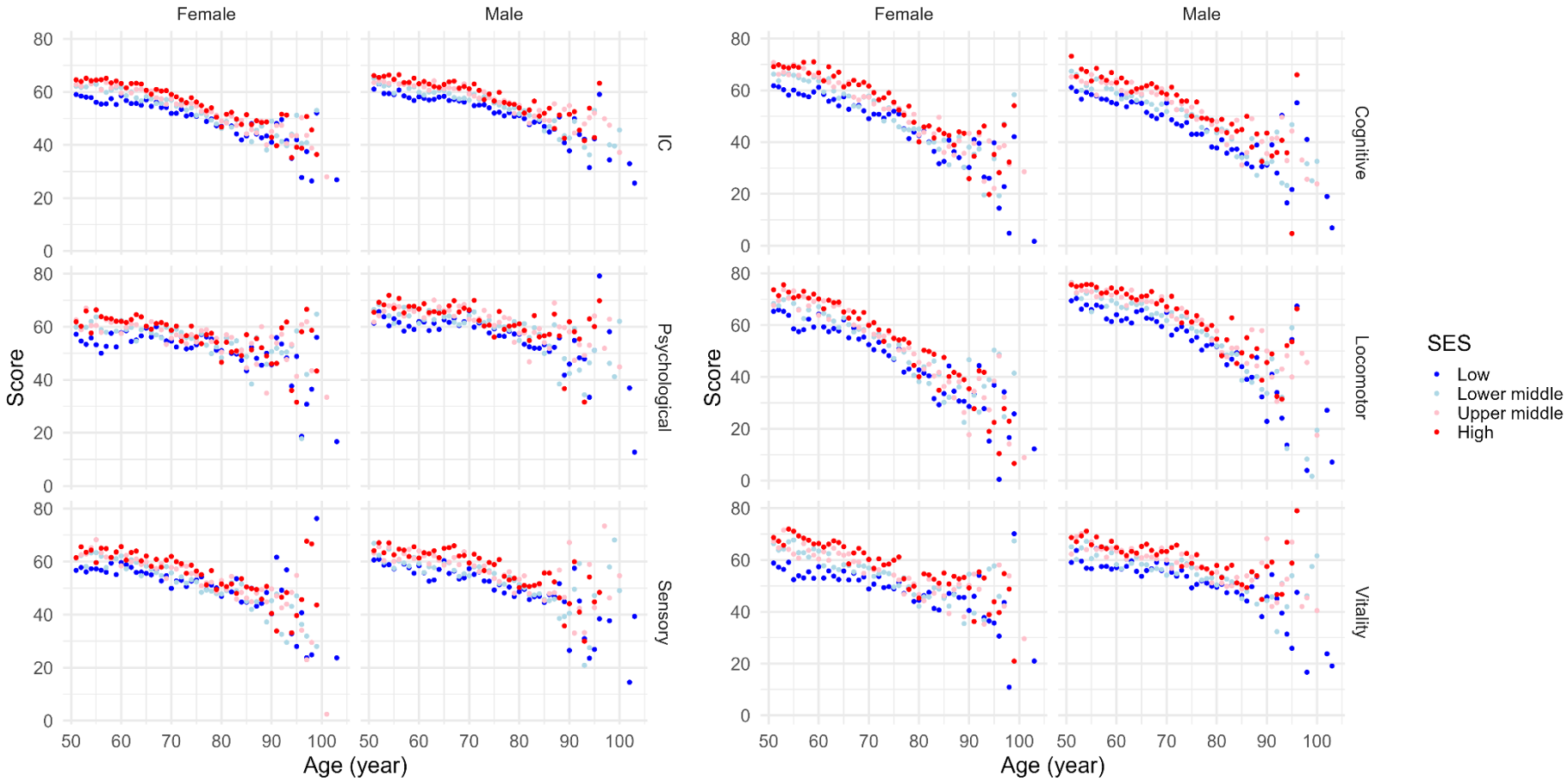
**eTable 6.** Mean Values and Standard Deviations of IC and Subdomains Across Genders and Countries

| Country | gender | IC (SD) | Psychological (SD) | Sensory (SD) | Cognitive (SD) | Locomotor (SD) | Vitality (SD) |
|---|---|---|---|---|---|---|---|
| **Austria** | Women | 60.631 (10.978) | 64.841 (17.703) | 60.886 (16.566) | 65.566 (17.849) | 62.161 (22.070) | 61.966 (20.219) |
| | Men | 62.505 (10.408) | 69.777 (18.033) | 61.820 (15.713) | 63.957 (16.583) | 67.705 (19.416) | 63.042 (18.630) |
| **Belgium** | Women | 58.077 (11.356) | 58.562 (19.815) | 60.638 (17.616) | 60.469 (18.451) | 59.162 (22.752) | 58.652 (20.593) |
| | Men | 60.658 (10.366) | 63.187 (20.013) | 61.409 (17.118) | 60.613 (17.866) | 66.682 (18.944) | 61.190 (18.924) |
| **Czech Republic** | Women | 57.333 (11.402) | 59.619 (18.983) | 55.160 (18.263) | 61.776 (17.343) | 59.576 (22.473) | 55.331 (19.982) |
| | Men | 60.03 (10.021) | 65.547 (18.639) | 56.882 (17.6) | 60.516 (15.851) | 66.413 (19.453) | 57.521 (18.236) |
| **Denmark** | Women | 63.448 (10.998) | 66.876 (18.665) | 69.687 (18.466) | 65.192 (17.492) | 67.833 (20.818) | 64.932 (20.919) |
| | Men | 65.052 (9.733) | 70.945 (18.435) | 71.188 (17.467) | 63.004 (16.31) | 72.762 (17.551) | 66.704 (18.383) |
| **Estonia** | Women | 55.087 (11.26) | 58.042 (17.278) | 51.682 (17.904) | 59.828 (18.36) | 55.000 (23.807) | 52.637 (19.526) |
| | Men | 56.968 (10.158) | 60.695 (17.444) | 50.788 (16.851) | 56.400 (17.212) | 60.721 (20.833) | 57.542 (18.016) |
| **France** | Women | 56.923 (11.868) | 54.906 (19.756) | 60.021 (19.589) | 57.737 (19.278) | 58.689 (23.184) | 57.772 (21.009) |
| | Men | 59.781 (10.596) | 61.315 (19.578) | 62.037 (18.985) | 56.874 (17.351) | 66.479 (19.192) | 60.889 (18.477) |
| **Germany** | Women | 58.317 (11.211) | 58.928 (18.318) | 59.032 (17.637) | 60.798 (18.079) | 60.197 (22.356) | 59.866 (20.303) |
| | Men | 60.17 (10.507) | 63.785 (19.027) | 60.463 (17.726) | 58.907 (17.029) | 65.653 (19.710) | 60.550 (18.827) |
| **Israel** | Women | 57.787 (12.099) | 62.683 (20.385) | 56.829 (17.425) | 56.667 (17.333) | 60.461 (23.871) | 58.040 (19.384) |
| | Men | 60.722 (10.811) | 67.770 (19.682) | 59.014 (17.409) | 57.217 (16.395) | 67.789 (19.591) | 60.899 (18.240) |
| **Italy** | Women | 52.786 (11.814) | 52.253 (20.964) | 49.766 (18.634) | 49.534 (18.193) | 53.384 (22.052) | 54.813 (20.312) |
| | Men | 56.374 (10.54) | 58.654 (20.178) | 52.046 (17.975) | 51.328 (17.35) | 61.870 (17.840) | 57.893 (18.117) |
| **Luxembourg** | Women | 57.238 (11.451) | 57.848 (18.856) | 60.790 (17.998) | 58.731 (18.687) | 57.834 (22.063) | 56.867 (20.940) |
| | Men | 58.836 (10.867) | 62.462 (19.124) | 61.621 (17.08) | 56.699 (17.76) | 64.581 (19.738) | 56.410 (20.890) |
| **Netherlands** | Women | 58.618 (10.588) | 60.789 (19.351) | 56.929 (17.197) | 61.792 (17.042) | 61.381 (21.022) | 59.375 (20.724) |
| | Men | 61.523 (9.385) | 65.076 (20.508) | 59.336 (17.146) | 59.928 (16.798) | 68.458 (16.605) | 62.877 (16.709) |
| **Slovenia** | Women | 56.031 (11.362) | 59.437 (17.592) | 55.063 (16.813) | 55.521 (18.798) | 57.169 (23.502) | 55.278 (19.868) |
| | Men | 59.125 (10.322) | 64.979 (17.061) | 57.859 (16.596) | 56.688 (18.174) | 65.822 (20.324) | 57.353 (17.934) |
| **Spain** | Women | 53.541 (11.773) | 57.529 (21.435) | 51.272 (16.528) | 48.402 (18.643) | 55.707 (22.715) | 52.167 (19.775) |
| | Men | 56.150 (10.700) | 65.070 (19.314) | 51.053 (15.877) | 48.091 (18.097) | 61.843 (19.858) | 55.428 (17.881) |
| **Sweden** | Women | 60.563 (10.775) | 61.141 (18.050) | 65.661 (20.139) | 62.615 (17.479) | 63.651 (20.272) | 62.029 (20.228) |
| | Men | 62.090 (9.897) | 65.611 (18.659) | 66.997 (18.602) | 58.852 (16.479) | 69.698 (17.190) | 61.799 (19.204) |
| **Switzerland** | Women | 61.739 | 63.747 | 58.750 | 65.226 | 67.216 | 64.790 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | (10.187) | (17.184) | (16.258) | (17.391) | (18.798) | (19.675) |
| | Men | 64.054<br>(9.291) | 68.555<br>(18.021) | 61.484<br>(16.315) | 64.251<br>(16.643) | 72.990<br>(15.429) | 66.560<br>(17.749) |

*Note:* SD: standard deviation. Scores are weighted using calibrated weights.

**eFigure 4**. Mean Values of IC and Subdomains Scores for Different Genders and Socioeconomic Status Groups




*Note*: SES is an abbreviation of socio-economic status.

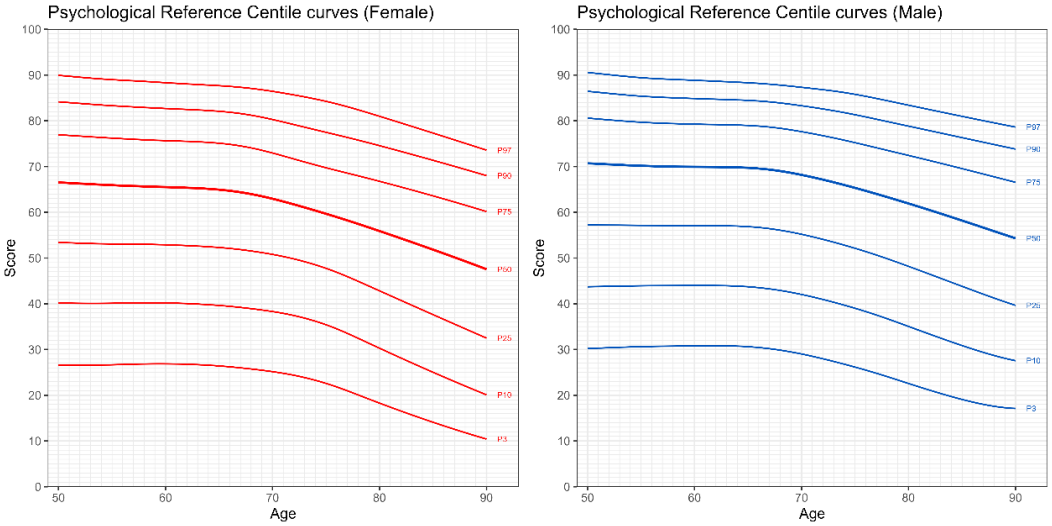
**eTable 7.** Mean Value of IC and Subdomains for Participants of Different Ages, Socioeconomic Statuses, and Genders

| Gender | Age | SES | IC | Psychological | Sensory | Cognitive | Locomotor | Vitality |
|---|---|---|---|---|---|---|---|---|
| Women | 70-74 | 1st quartile | 50.748 | 56.617 | 52.793 | 45.938 | 63.109 | 56.069 |
| | | 2nd quartile | 53.901 | 60.264 | 54.376 | 49.155 | 66.353 | 59.286 |
| | | 3rd quartile | 55.720 | 59.798 | 58.657 | 49.956 | 68.417 | 61.953 |
| | | 4th quartile | 57.074 | 60.836 | 60.206 | 52.457 | 68.467 | 62.247 |
| | 75-79 | 1st quartile | 46.077 | 55.128 | 50.000 | 41.163 | 55.924 | 52.618 |
| | | 2nd quartile | 48.474 | 56.483 | 50.184 | 42.570 | 59.644 | 54.978 |
| | | 3rd quartile | 50.860 | 58.365 | 52.918 | 46.507 | 62.840 | 55.705 |
| | | 4th quartile | 50.573 | 56.770 | 53.194 | 45.636 | 61.650 | 57.320 |
| | 80-84 | 1st quartile | 40.109 | 50.821 | 44.959 | 34.681 | 47.982 | 48.529 |
| | | 2nd quartile | 42.559 | 52.767 | 47.150 | 36.707 | 51.478 | 49.899 |
| | | 3rd quartile | 44.888 | 54.191 | 48.587 | 40.284 | 54.394 | 51.625 |
| | | 4th quartile | 46.062 | 52.760 | 50.146 | 39.045 | 56.175 | 54.625 |
| | 85-89 | 1st quartile | 36.305 | 46.810 | 40.714 | 30.710 | 43.109 | 47.454 |
| | | 2nd quartile | 37.862 | 49.758 | 41.620 | 33.843 | 44.110 | 48.216 |
| | | 3rd quartile | 40.055 | 49.602 | 45.439 | 32.758 | 47.563 | 50.556 |
| | | 4th quartile | 42.449 | 52.209 | 46.454 | 35.946 | 50.657 | 52.751 |
| | >=90 | 1st quartile | 32.826 | 43.900 | 37.656 | 26.608 | 38.791 | 44.846 |
| | | 2nd quartile | 33.035 | 45.416 | 35.081 | 27.987 | 38.985 | 47.914 |
| | | 3rd quartile | 39.045 | 51.366 | 43.504 | 33.627 | 42.930 | 51.431 |
| | | 4th quartile | 36.481 | 47.883 | 39.304 | 30.023 | 42.494 | 48.475 |
| Men | 70-74 | 1st quartile | 54.251 | 62.387 | 55.202 | 44.794 | 68.154 | 59.415 |
| | | 2nd quartile | 57.914 | 65.614 | 58.305 | 48.289 | 72.487 | 61.891 |
| | | 3rd quartile | 58.652 | 65.871 | 58.976 | 49.510 | 73.259 | 63.199 |
| | | 4th quartile | 60.505 | 66.626 | 61.110 | 52.257 | 74.663 | 65.783 |
| | 75-79 | 1st quartile | 50.146 | 59.621 | 50.418 | 40.011 | 63.696 | 56.043 |
| | | 2nd quartile | 54.104 | 62.574 | 54.401 | 44.790 | 67.993 | 59.147 |
| | | 3rd quartile | 56.176 | 63.817 | 54.896 | 46.658 | 71.090 | 61.915 |
| | | 4th quartile | 56.539 | 63.347 | 57.476 | 46.970 | 70.554 | 62.021 |
| | 80-84 | 1st quartile | 46.388 | 55.401 | 47.782 | 36.093 | 58.979 | 54.030 |
| | | 2nd quartile | 47.987 | 58.241 | 48.472 | 38.445 | 59.460 | 55.654 |
| | | 3rd quartile | 50.103 | 57.961 | 52.018 | 41.013 | 63.360 | 56.331 |
| | | 4th quartile | 51.665 | 60.838 | 51.608 | 42.013 | 64.079 | 58.860 |
| | 85-89 | 1st quartile | 41.461 | 52.037 | 45.167 | 31.792 | 51.889 | 51.072 |
| | | 2nd quartile | 42.059 | 52.091 | 42.817 | 33.573 | 52.843 | 51.160 |
| | | 3rd quartile | 48.128 | 57.393 | 47.349 | 36.186 | 60.168 | 56.322 |
| | | 4th quartile | 50.289 | 58.136 | 52.823 | 41.164 | 63.926 | 57.076 |
| | >=90 | 1st quartile | 36.968 | 48.162 | 39.803 | 30.391 | 43.915 | 48.331 |
| | | 2nd quartile | 34.365 | 44.139 | 34.614 | 26.969 | 41.669 | 47.568 |
| | | 3rd quartile | 42.598 | 51.567 | 42.717 | 36.229 | 49.545 | 54.858 |
| | | 4th quartile | 45.777 | 56.947 | 45.840 | 36.512 | 53.934 | 57.055 |

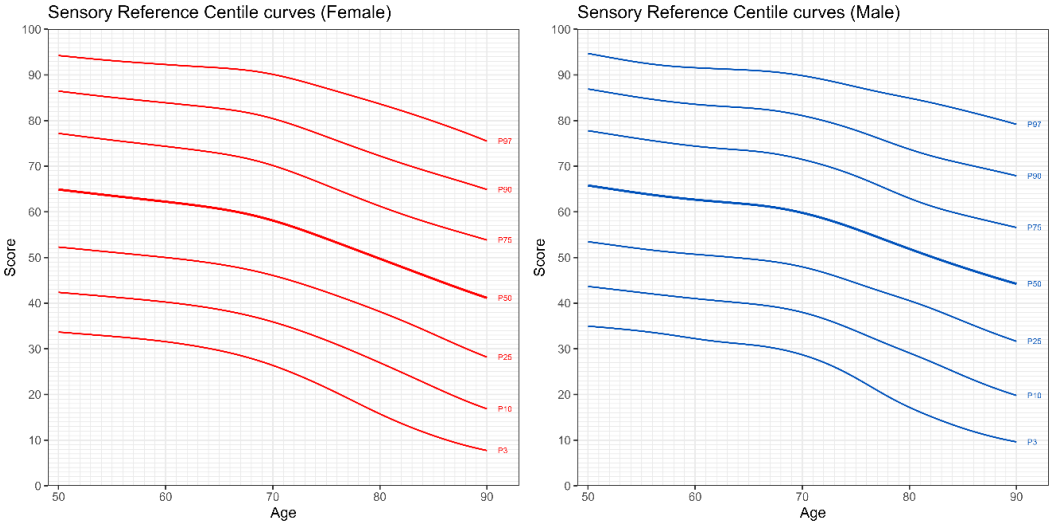
*Note:* 1st quartile denotes the lowest socio-economic status, while 4th quartile denotes the highest.

**eFigure 5**. Centile Curves for Subdomains

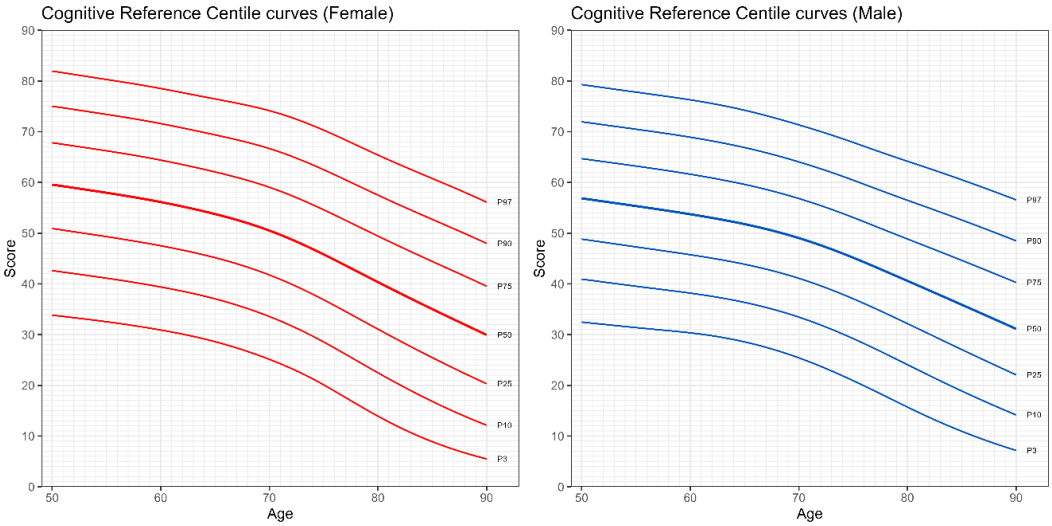
**a)**. Centile curves for psychological subdomain.



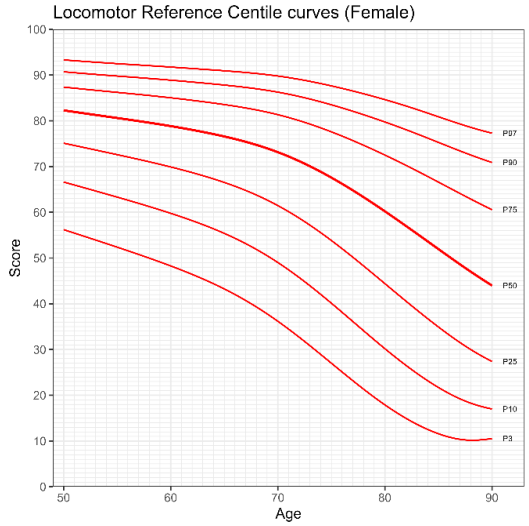

**b)**. Centile curves for sensory subdomain.

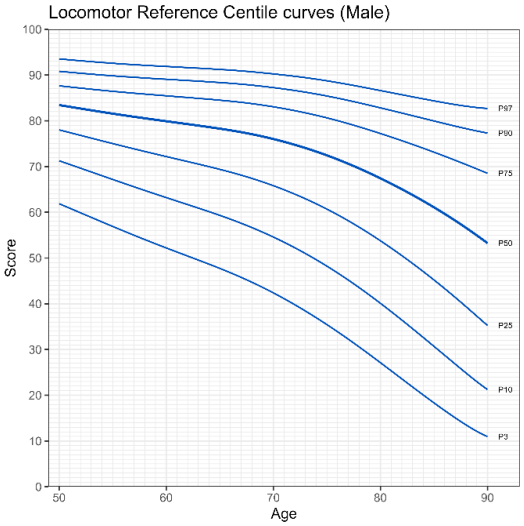



**c)**. Centile curves for cognitive subdomain.

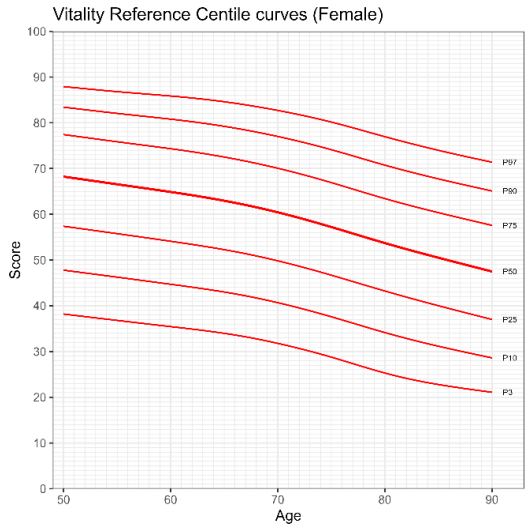


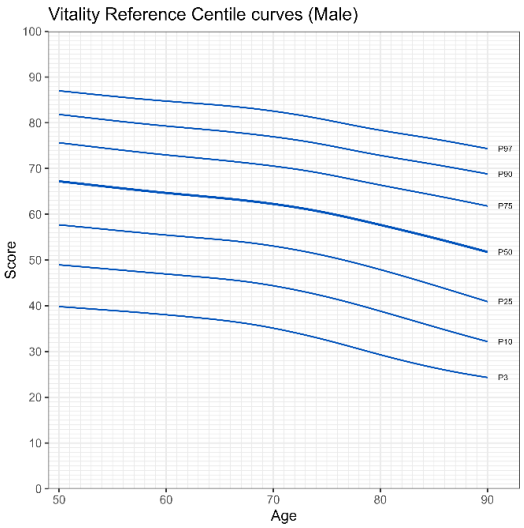
**d)**. Centile curves for locomotor subdomain.



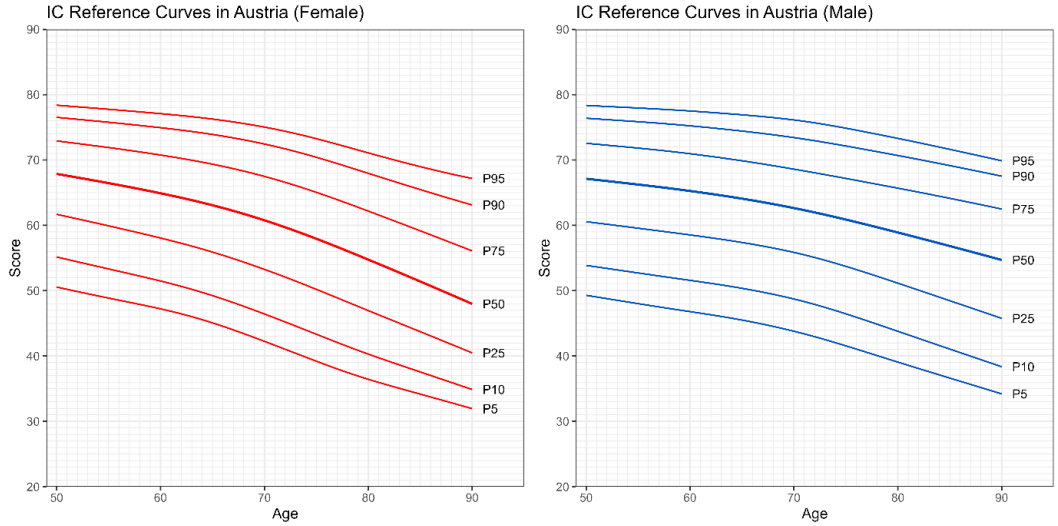

**e)**. Centile curves for vitality subdomain.



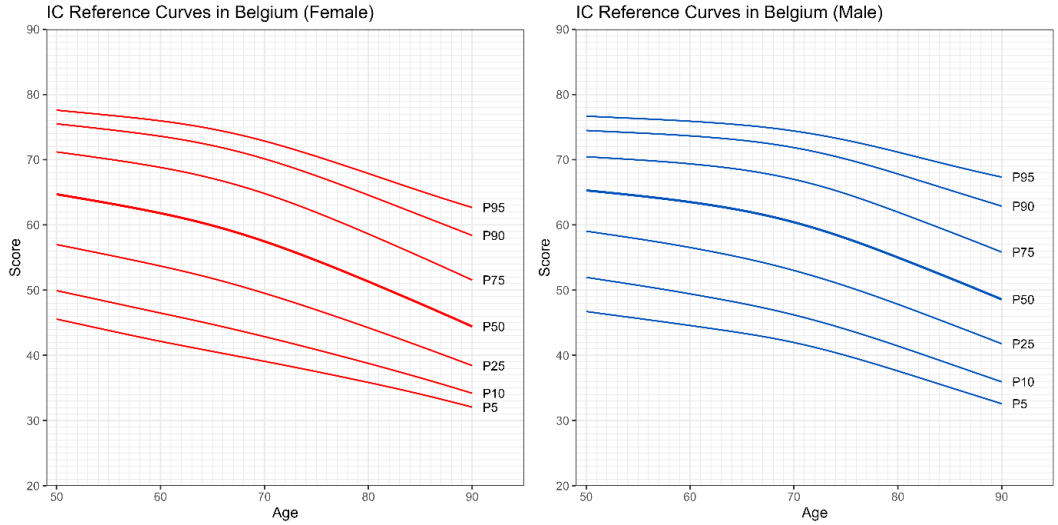



**eFigure 6.** Centile Curves for IC in Different Countries

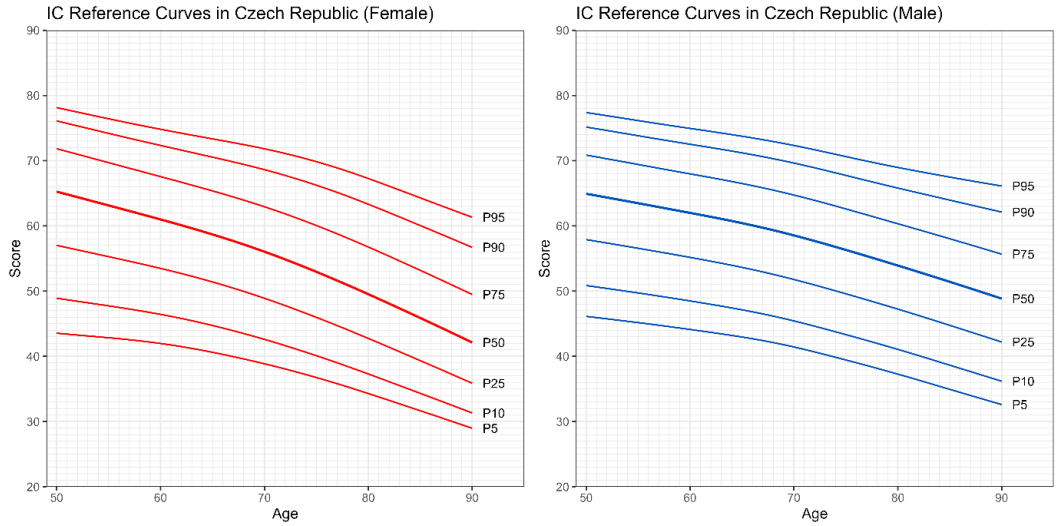
**a). Austria**



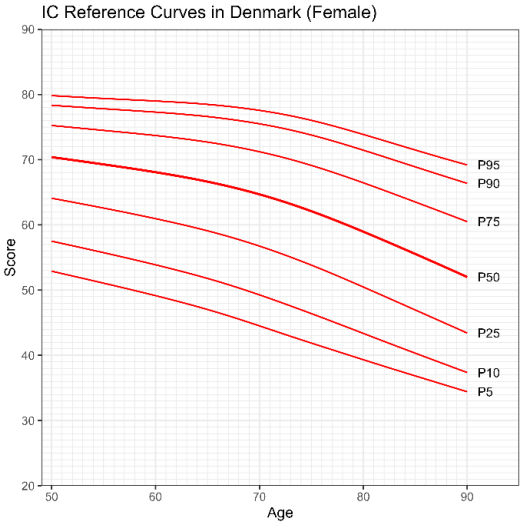

**b). Belgium**

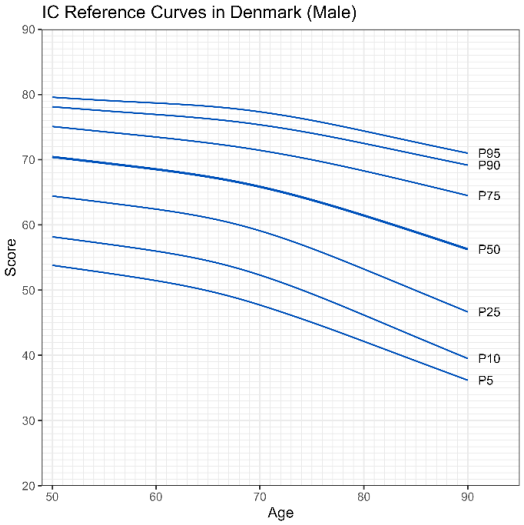



**c). Czech Republic**

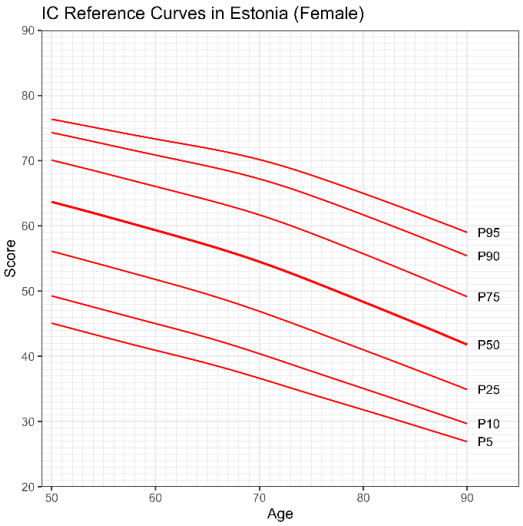


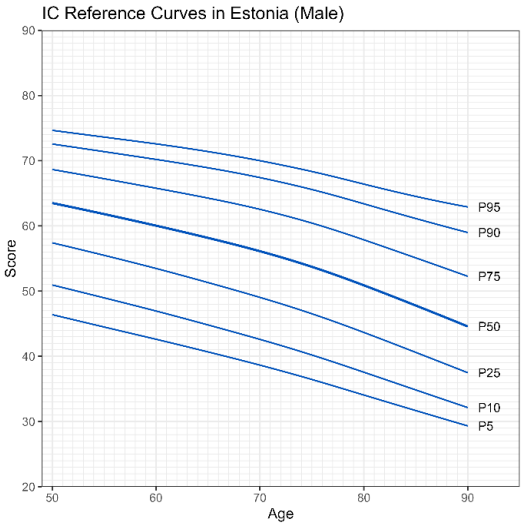
**d). Denmark**



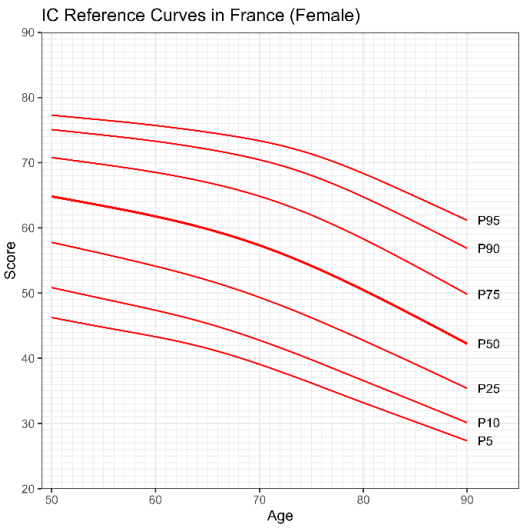



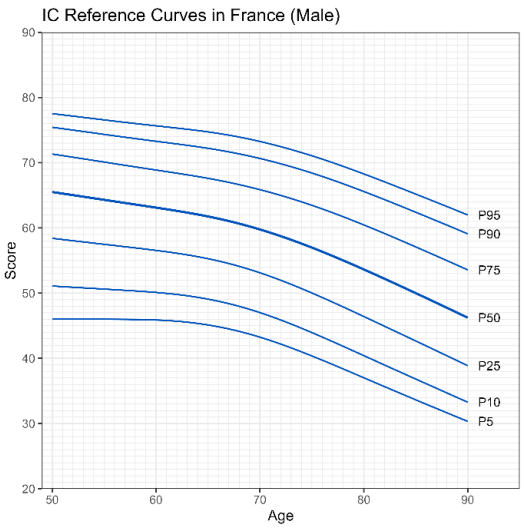

**e). Estonia**



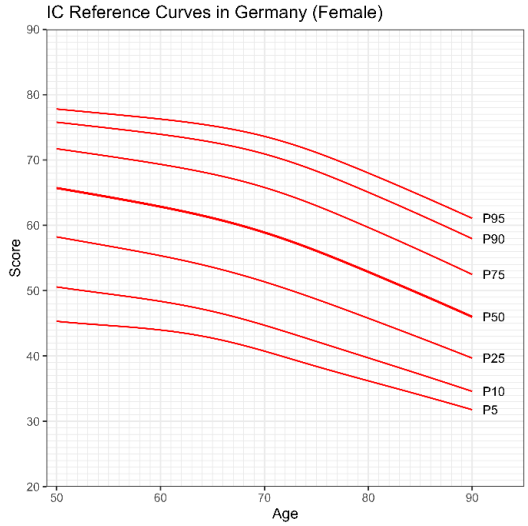



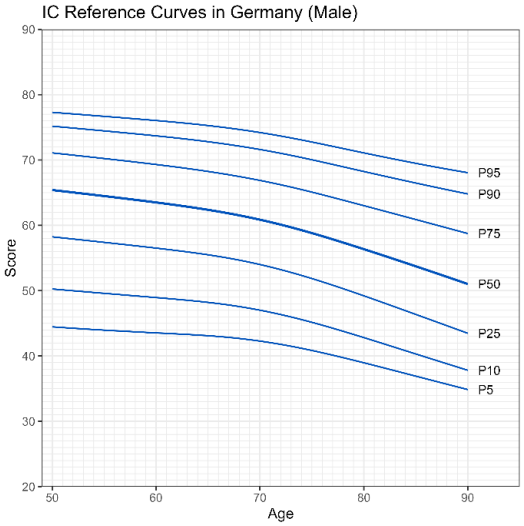

**f). France**



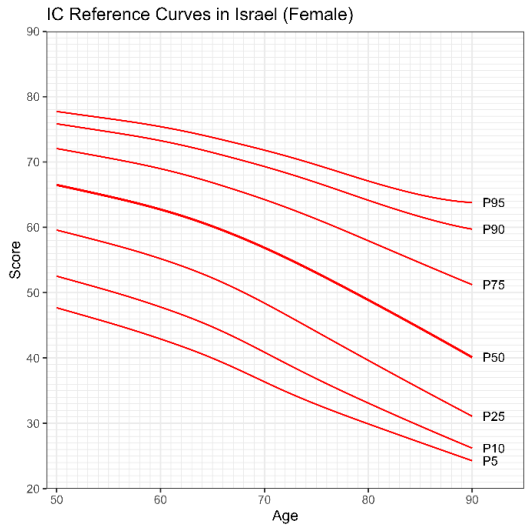



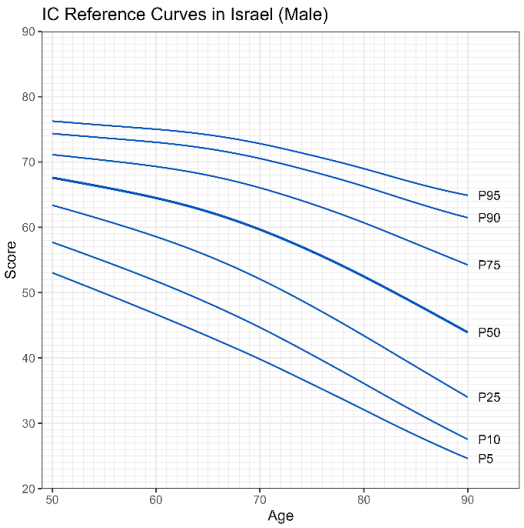
## g). Germany



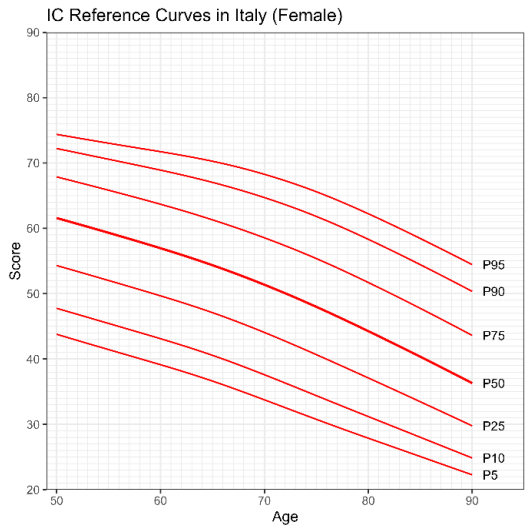



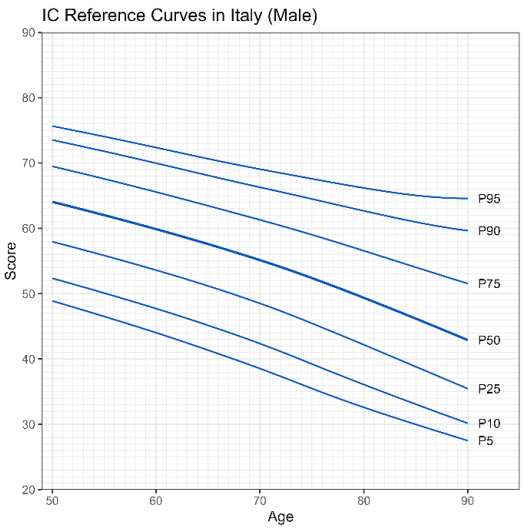

## h). Israel



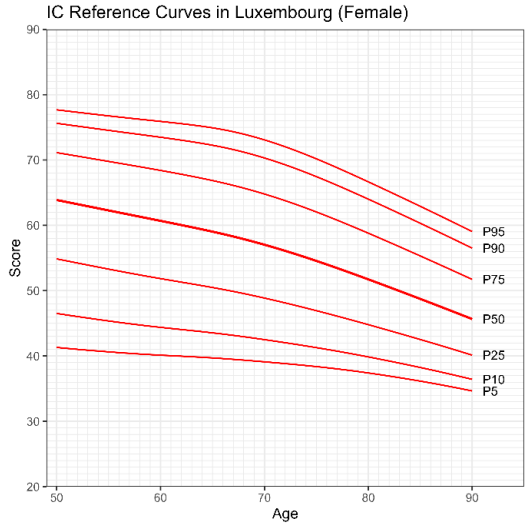



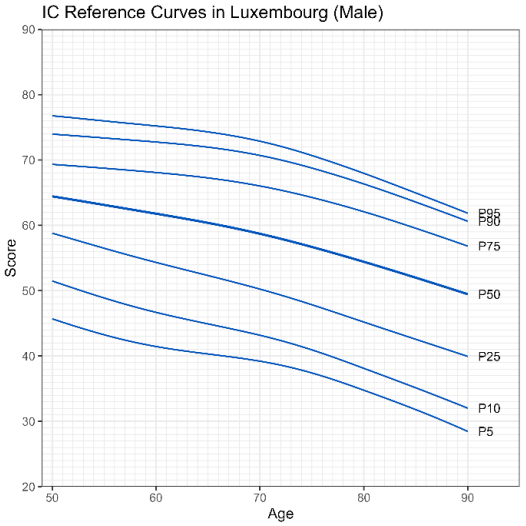

## i). Italy



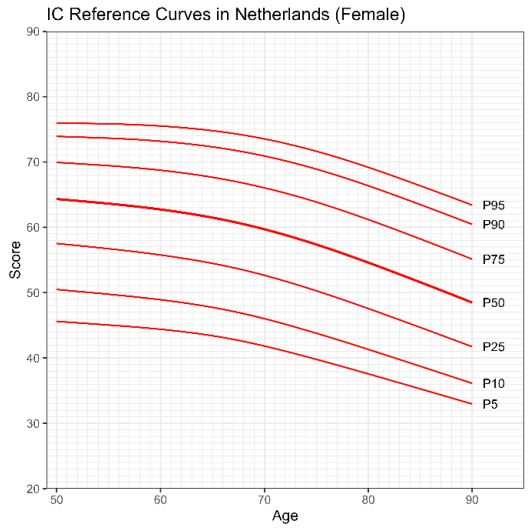



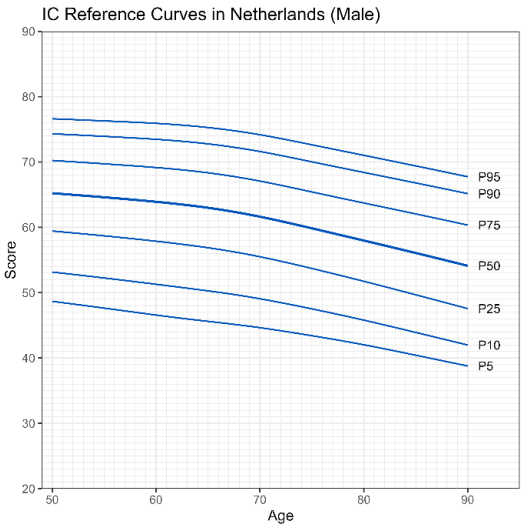
## j). Luxembourg



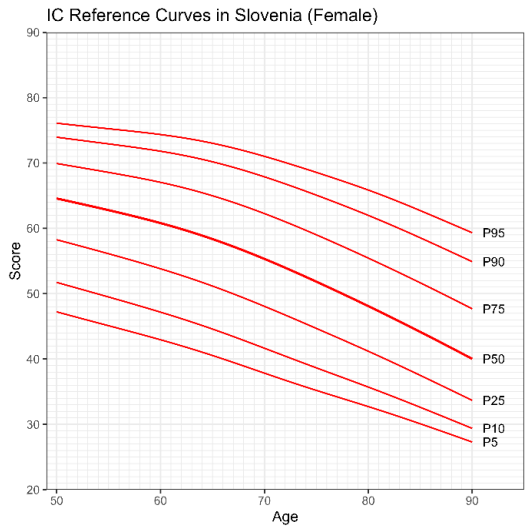



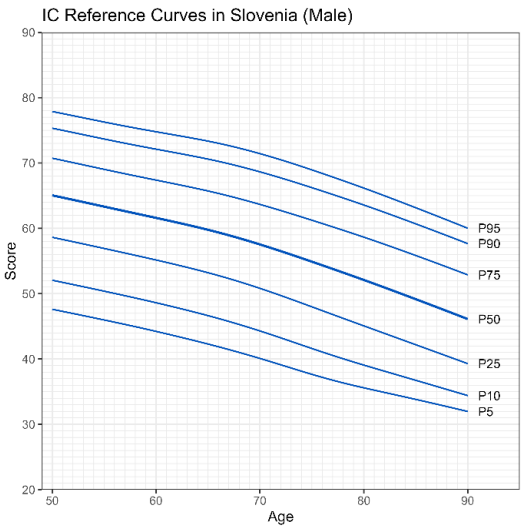

## k). Netherlands



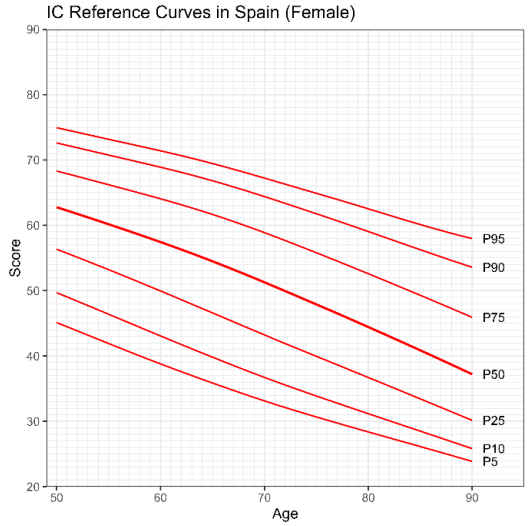



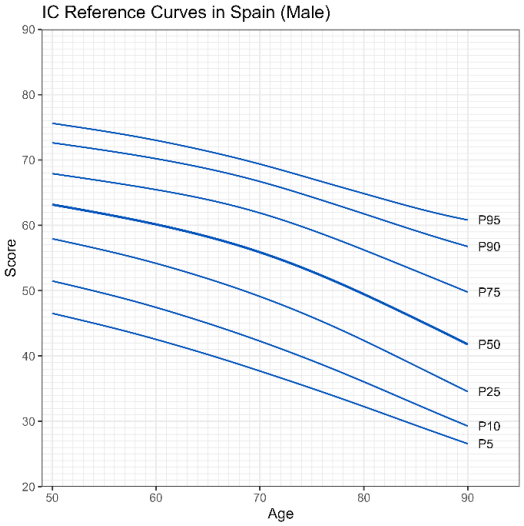

## l). Slovenia



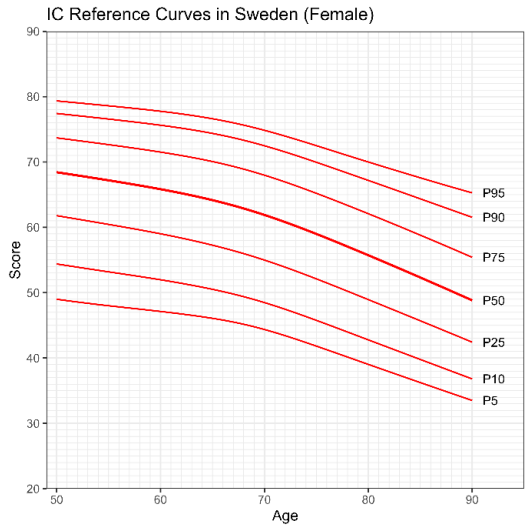



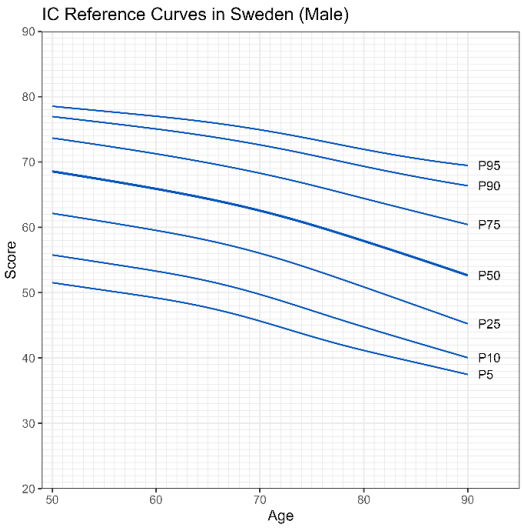
## m). Spain



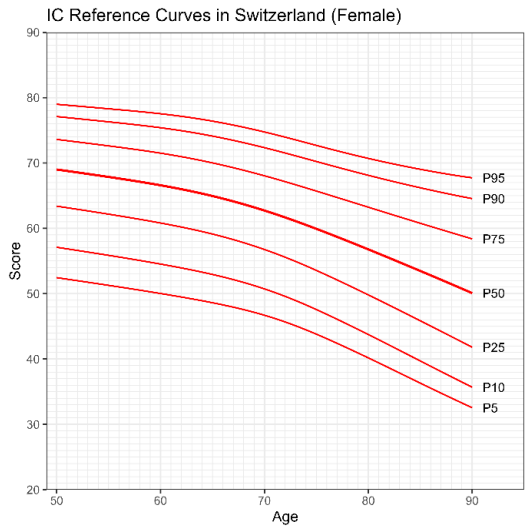



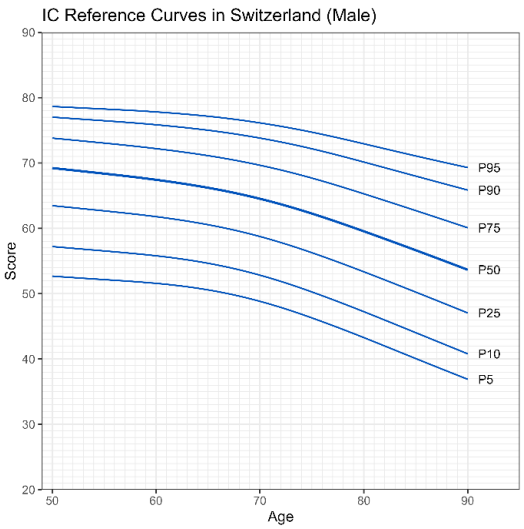

## n). Sweden



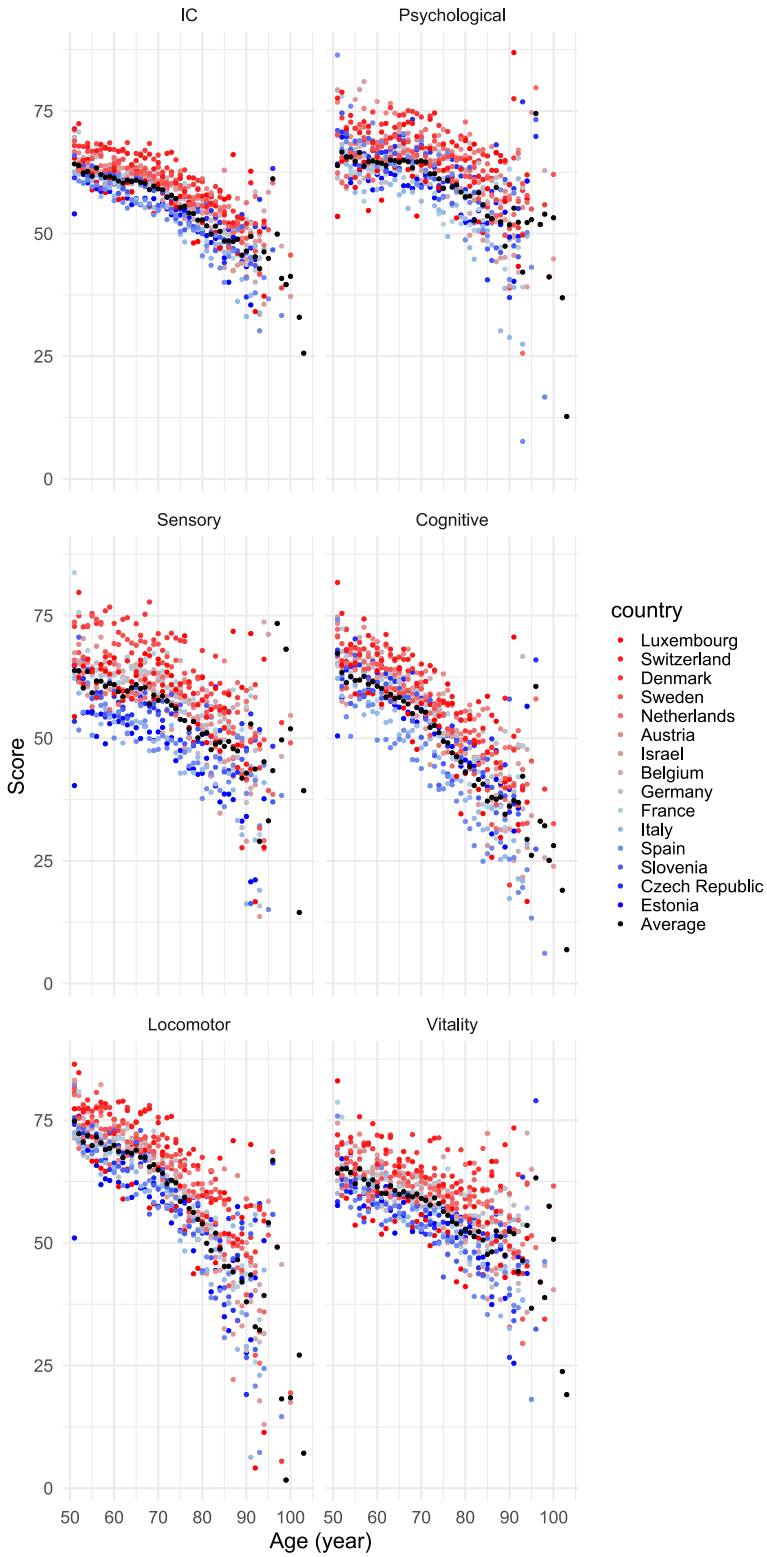




## o). Switzerland



**eFigure 7.** Intrinsic Capacity and Subdomain Scores Across Different Countries for Men




*Note*: Each point represents the mean score for IC or its subdomains for participants of a certain age across different countries. Black points indicate the overall mean values across all the countries. Countries are ordered by 2013 gross domestic product (GDP) per capita: those with a higher GDP per capita are depicted in red, while those with a lower GDP per capita are depicted in blue. GDP per capita data for the studied countries were retrieved from World Bank Group.

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