Supplement

**Analytic Approach**

*Baseline life satisfaction and cognitive functioning/decline*

To examine the association between baseline life satisfaction (LS) with cognitive functioning (MMSE) and cognitive decline over time, two-level Multilevel Modeling (MLM; Raudenbush & Bryk, 2002) was conducted. Level 1 is the assessment (time) level, and Level 2 is the person level. MMSE is the Level 1 outcome variable, linear time (coded as 0-6 for Wave 1-7) is the Level 1 predictor, and baseline LS is the Level 2 predictor. An unconditional model (with no predictors) was conducted to ensure significant variance in the outcome variable (MMSE) at both levels before proceeding to primary analyses (Raudenbush & Bryk, 2002). The following slope-and-intercept-as-outcomes model (equations 1-3) was used to model the intercept and slope of MMSE as the outcome of baseline LS. The same model was used for analyzing domain satisfaction.

Level 1:

MMSE*it* = β0*it* + β1*it* (time) + r*it* (1)

Level 2:

β0*i* = γ00 + γ01 (baseline LS) + u0*i* (2)

β1*i* = γ10 + γ11 (baseline LS) + u1*i* (3)

Baseline LS was grand mean centered by subtracting the sample mean from the raw variable. β0it can be interpreted as a person’s level of MMSE at Wave 1 (intercept), and β1it represents the expected change in MMSE associated with time (slope). r*it* is an error term, representing a unique effect associated with each person. The fixed effect γ00 represents the mean MMSE for the sample (sample mean), γ01 (a main coefficient of interest)represents individual differences in MMSE levels associated with differences in baseline LS, γ10 represents the average slope of MMSE decline in the sample, and γ11 represents thecross-level interaction between baseline LS and time, that is, the differences in rate of MMSE decline associated with differences in baseline LS. The random effect u0*i* represents the degree to which people vary from the sample mean of MMSE, and u1*i*represents the degree to which people vary from the slope of MMSE decline.

*Within-person association between life satisfaction and cognitive functioning*

To examine the within-person association between LS and cognitive functioning, another two-level MLM was conducted. Level 1 is the assessment (time) level, and Level 2 is the person level. LS is the Level 1 predictor and MMSE is the Level 1 outcome variable, both measured at each of the seven assessment occasions. In other words, LS is a time-varying covariate, which refers to a Level 1 predictor that is not time or age. The following model (equations 4-6) was used to examine the within-person association between LS and MMSE. The same model was used for analyzing domain satisfaction.

Level 1:

MMSE*it* = β0*it* + β1*it* (LS) + r*it* (4)

Level 2:

β0*i* = γ00 + u0*i* (5)

β1*i* = γ10 + u1*i* (6)

LS was person mean centered by subtracting the person mean from the raw variable. β0it can be interpreted as a person’s level of MMSE on occasions when LS is at their own mean level (intercept), and β1it represents the expected change in MMSE associated with the person’s change in LS (slope). r*it* is an error term, representing a unique effect associated with each person. The fixed effect γ00 represents the mean MMSE for the sample (sample mean), γ10 (the main coefficient of interest)represents the average slope in the sample, u0*i* represents the degree to which people vary from the sample mean of MMSE, and u1*i*represents the degree to which people vary from the slope.

**Table S1.**

*Multilevel models of baseline domain satisfaction predicting cognitive functioning*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Satisfaction with health** |  | **Satisfaction with economic status** |  | **Satisfaction with relationship with spouse** |  | **Satisfaction with relationship with children** |
| Fixed effects | Coefficient (*SE*) |  | Coefficient (*SE*) |  | Coefficient (*SE*) |  | Coefficient (*SE*) |
| **Cognitive functioning** |  |  |  |  |  |  |  |
| Intercept | 26.91\*\*\*(0.07) |  | 26.91\*\*\*(0.07) |  | 26.96\*\*\*(0.07) |  | 26.93\*\*\*(0.07) |
| Age | -0.10\*\*\*(0.004) |  | -0.10\*\*\* (0.004) |  | -0.09\*\*\* (0.004) |  | -0.10\*\*\* (0.004) |
| Gender | -0.68\*\*\*(0.07) |  | -0.74\*\*\* (0.07) |  | -0.54\*\*\* (0.08) |  | -0.76\*\*\* (0.07) |
| Depressive symptoms | -0.12\*\*\*(0.02) |  | -0.13\*\*\* (0.02) |  | -0.15\*\*\* (0.02) |  | -0.15\*\*\* (0.02) |
| Hypertension | -0.02 (0.07) |  | -0.08 (0.07) |  | -0.20\*\* (0.08) |  | -0.10 (0.07) |
| Diabetes | -0.20\* (0.10) |  | -0.32\*\*(0.10) |  | -0.36\*\*(0.10) |  | -0.33\*\*(0.10) |
| Heart-related diseases | 0.35\* (0.14) |  | 0.21 (0.14) |  | 0.06 (0.16) |  | 0.11 (0.15) |
| ADL | -0.41\*\*\*(0.07) |  | -0.50\*\*\* (0.07) |  | -0.52\*\*\* (0.07) |  | -0.52\*\*\* (0.07) |
| Exercise | 0.47\*\*\*(0.06) |  | 0.51\*\*\*(0.06) |  | 0.45\*\*\*(0.07) |  | 0.56\*\*\*(0.06) |
| Smoking | 0.02 (0.09) |  | 0.06 (0.09) |  | 0.09 (0.09) |  | 0.07 (0.09) |
| Social contact | -0.05\*\*\*(0.01) |  | -0.05\*\*\*(0.01) |  | -0.04\*\*(0.01) |  | -0.05\*\*\*(0.01) |
| Education | 0.65\*\*\* (0.03) |  | 0.65\*\*\*(0.03) |  | 0.68\*\*\*(0.03) |  | 0.67\*\*\*(0.03) |
| Baseline satisfaction | 0.02\*\*\* (0.001) |  | 0.01\*\*\* (0.001) |  | 0.01\*\*\* (0.002) |  | 0.01\*\* (0.002) |
| Age × baseline satisfaction | 0.001\*\*\*(0.0001) |  | 0.001\*\*\* (0.0001) |  | 0.001\*\*\* (0.0002) |  | 0.001\*\* (0.0002) |
| **Slope** |  |  |  |  |  |  |  |
| Time | -0.33\*\*\*(0.02) |  | -0.33\*\*\*(0.02) |  | -0.33\*\*\*(0.02) |  | -0.33\*\*\*(0.02) |
| Age × time | -0.03\*\*\*(0.001) |  | -0.03\*\*\*(0.001) |  | -0.03\*\*\*(0.001) |  | -0.03\*\*\*(0.001) |
| Gender × time | -0.03 (0.02) |  | -0.03 (0.02) |  | -0.01 (0.02) |  | -0.04 (0.02) |
| Depressive symptoms × time | -0.002 (0.007) |  | -0.002 (0.007) |  | -0.0002 (0.008) |  | -0.0004 (0.007) |
| Hypertension × time | 0.05\* (0.02) |  | 0.05 (0.02) |  | 0.06\* (0.03) |  | 0.05\* (0.02) |
| Diabetes × time | -0.04 (0.03) |  | -0.04 (0.03) |  | -0.02 (0.04) |  | -0.03 (0.03) |
| Heart-related diseases × time | -0.09 (0.05) |  | -0.10\* (0.05) |  | -0.13\* (0.05) |  | -0.10\* (0.05) |
| ADL × time | -0.02 (0.03) |  | -0.02 (0.03) |  | -0.04 (0.03) |  | -0.03 (0.03) |
| Exercise × time | -0.01 (0.02) |  | -0.01 (0.02) |  | -0.02 (0.02) |  | -0.01 (0.02) |
| Smoking × time | -0.05 (0.03) |  | -0.05 (0.03) |  | -0.02 (0.03) |  | -0.05 (0.03) |
| Social contact × time | 0.02\*\*\*(0.004) |  | 0.02\*\*\*(0.004) |  | 0.02\*\*\*(0.004) |  | 0.02\*\*\*(0.004) |
| Education × time | -0.004 (0.01) |  | -0.005 (0.01) |  | 0.006 (0.01) |  | -0.002 (0.01) |
| Baseline satisfaction × time | 0.0003 (0.0005) |  | 0.0005 (0.0005) |  | -0.00004 (0.001) |  | -0.0003 (0.001) |
| Age × baseline satisfaction × time | 0.0002\*\*\*(0.00005) |  | 0.0002\*\*(0.00004) |  | 0.0002\*\*(0.0001) |  | 0.0002\*\*\*(0.0001) |

*Note.* Satisfaction with health and economic status: *n*=8016; satisfaction with relationship with spouses: *n*=6559; satisfaction with relationship with children: *n*=7820. On single-item measures with a scale of 0-100, participants rated how satisfied they were with their health, economic status, relationship with spouses, and relationship with children. Higher scores indicated higher satisfaction. Except time, all variables were baseline measures. Gender: 0=men, 1=women. ADL=activities of daily living (functional limitations, range=0-7). Social contact: Participants self-reported how often they visit close friends or relatives, 1=Almost every day, 2=Once a week, 3=two or three times a week, 4=Once a month, 5=Twice a month (every two weeks), 6=Once or twice a year, 7=Three or four times a year (once every three or four months), 8=Five or six times a year (every two months), 9=Almost never a year, 10=No close friend or relative. The item was reverse coded such that higher scores indicated more frequent contact (range=1-10). Age × Satisfaction: Interaction between age and a domain satisfaction indicator. As with overall life satisfaction, we also tested age × satisfaction × time (last row of the table): the interaction between age, domain satisfaction, and time. This interaction is illustrated in Figure S1-S4 of this supplement.

\**p*<.05. \*\**p*<.01. \*\*\**p*<.0001

**Table S2.**

*Multilevel models of time-varying domain satisfaction predicting cognitive functioning*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Satisfaction with health** |  | **Satisfaction with economic status** |  | **Satisfaction with relationship with spouse** |  | **Satisfaction with relationship with children** |
| Fixed effects | | Coefficient *(SE)* |  | Coefficient *(SE)* |  | Coefficient *(SE)* |  | Coefficient *(SE)* |
| **Cognitive functioning** | |  |  |  |  |  |  |  |
|  | Intercept | 26.47\*\*\*(0.08) |  | 26.47\*\*\*(0.08) |  | 26.50\*\*\*(0.08) |  | 26.59\*\*\*(0.09) |
|  | Age | -0.15\*\*\*(0.003) |  | -0.15\*\*\*(0.003) |  | -0.12\*\*\*(0.004) |  | -0.15\*\*\*(0.003) |
|  | Gender | -0.82\*\*\*(0.06) |  | -0.81\*\*\*(0.06) |  | -0.57\*\*\*(0.07) |  | -0.86\*\*\*(0.07) |
|  | Education | 0.74\*\*\*(0.03) |  | 0.74\*\*\*(0.03) |  | 0.74\*\*\*(0.03) |  | 0.72\*\*\*(0.03) |
| **Slope** | |  |  |  |  |  |  |  |
|  | Linear time | -0.21\*\*\*(0.01) |  | -0.23\*\*\*(0.01) |  | -0.16\*\*\*(0.01) |  | -0.21\*\*\*(0.01) |
|  | Depressive symptoms, 0-10 | -0.18\*\*\*(0.01) |  | -0.19\*\*\*(0.01) |  | -0.19\*\*\*(0.01) |  | -0.18\*\*\*(0.01) |
|  | Hypertension | -0.15\*\* (0.05) |  | -0.16\*\* (0.05) |  | -0.18\*\* (0.05) |  | -0.13\* (0.06) |
|  | Diabetes | -0.24\*\*(0.06) |  | -0.23\*\*(0.06) |  | -0.13(0.07) |  | -0.28\*\*\* (0.07) |
|  | Heart-related disease | -0.21\*(0.09) |  | -0.22\*(0.09) |  | -0.32\*\*(0.09) |  | -0.11(0.10) |
|  | ADL, 0-7 | -1.37\*\*\*(0.03) |  | -1.44\*\*\*(0.02) |  | -1.51\*\*\*(0.03) |  | -1.25\*\*\*(0.03) |
|  | Exercise | 0.46\*\*\*(0.04) |  | 0.49\*\*\*(0.04) |  | 0.37\*\*\*(0.04) |  | 0.51\*\*\*(0.04) |
|  | Smoking | 0.09 (0.06) |  | 0.10 (0.06) |  | 0.19\*\* (0.06) |  | -0.02 (0.07) |
|  | Social contact, 1-10 | 0.09\*\*\*(0.01) |  | 0.10\*\*\*(0.01) |  | 0.09\*\*\*(0.01) |  | 0.09\*\*\*(0.01) |
|  | Satisfaction, 0-100 | 0.02\*\*\*(0.001) |  | 0.01\*\*\*(0.001) |  | 0.01\*\*\*(0.001) |  | 0.01\*\*\*(0.002) |

*Note.* Satisfaction with health and economic status: *n*=8016; satisfaction with relationship with spouses: *n*=6559; satisfaction with relationship with children: *n*=7820. Gender: 0=men, 1=women. ADL=activities of daily living (functional limitations). The “Satisfaction” row (last row of the table) presents the within-person associations between time-varying domain satisfaction and cognitive functioning, suggesting that on occasions when individuals have higher levels of satisfaction than their own average, they could also be expected to have higher cognitive functioning.

\**p*<.05. \*\**p*<.01. *\*\*\*p<*.0001.

**Table S3.**

*Cox regression analyses of baseline domain satisfaction predicting risk of incident dementia*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Satisfaction with health** | **Satisfaction with**  **economic status** | **Satisfaction with**  **relationship with spouse** | **Satisfaction with**  **relationship with children** |
| Mean (*SD*), 0-100,  Dementia cases / total | 48.40 (24.14)/  58.34 (23.56) | 42.51 (23.83)/  49.30 (23.73) | 69.25 (19.28)/  72.05 (19.00) | 71.27 (20.25)/  75.11 (18.86) |
| Model 1, # dementia | 1384/8021 | 1384/8021 | 897/6564 | 1342/7825 |
| Model 1, HR (95% CI) | 0.76 (0.72-0.80) | 0.82 (0.78-0.86) | 0.91 (0.86-0.97) | 0.91 (0.87-0.95) |
| Sensitivity analyses/Robustness check |  |  |  |  |
| Model 1.1, # dementia | 770/7407 | 770/7407 | 546/6213 | 751/7234 |
| Model 1.1, HR (95% CI) | 0.77 (0.72-0.82) | 0.83 (0.77-0.89) | 0.92 (0.85-1.00) | 0.92 (0.86-0.98) |
| Depressive symptoms covariate |  |  |  |  |
| Model 2, # dementia | 1384/8021 | 1384/8021 | 897/6564 | 1342/7825 |
| Model 2, HR (95% CI) | 0.77 (0.73-0.81) | 0.83 (0.78-0.87) | 0.92 (0.86-0.98) | 0.92 (0.88-0.97) |
| Cardiovascular and ADL covariates |  |  |  |  |
| Model 3, # dementia | 1384/8021 | 1384/8021 | 897/6564 | 1342/7825 |
| Model 3, HR (95% CI) | 0.77 (0.73-0.81) | 0.83 (0.79-0.88) | 0.92 (0.87-0.98) | 0.92 (0.88-0.97) |
| Behavioral, social, and education covariates |  |  |  |  |
| Model 4, # dementia | 1382/8016 | 1382/8016 | 896/6560 | 1340/7820 |
| Model 4, HR (95% CI) | 0.81 (0.77-0.85) | 0.88 (0.84-0.94) | 0.97 (0.91-1.03) | 0.96 (0.91-1.01) |

*Note.* Model 1 and Model 1.1 include the covariates age and gender; Model 1.1 excludes cases of incident dementia occurred at the first and second follow-ups; Model 2 was Model 1 plus depressive symptoms; Model 3 was Model 2 plus cardiovascular and ADL factors; Model 4 was Model 3 plus health behaviors (exercise and smoking), social contact, and education.

HR = Hazard Ratio; CI = Confidence Interval. All HR values are significant (*p*<.05) except the HRs for satisfaction with relationships with spouse and children in Model 4.

**Figure S1.** Three-way interaction between age, satisfaction with health, and time predicting cognitive functioning

**Figure S2.** Three-way interaction between age, satisfaction with economic status, and time predicting cognitive functioning

**Figure S3.** Three-way interaction between age, satisfaction with relationship with spouses, and time predicting cognitive functioning

**Figure S4.** Three-way interaction between age, satisfaction with relationship with children, and time predicting cognitive functioning