Analysing change and adressing heterogenity using SHARE data: Exemples of physical activity, mental health and cognitive function

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Aim of presentation

- Illustrate how SHARE-data can be used to examine change and change associations
- Demonstrate (very briefly) how person-centered analysis can be used to understand heterogenity (in terms of cognition) in change in SHARE data
- As a side-point (extra benefit), show some exemples of conceptual links between longitudinal associations of physical activities, mental health (depression) and cognitive function in SHARE

Using SHARE data: Some reflections

- Takes a lot of time to prepare. Takes patience…BUT
- +Very user-friendly data, not least considering the large size and scope of data
- +Well organized data sets, well structured (”ordning och reda”)
- +Thorough documentation, easy to track things
- +Nice and quick support
- +- Limited amount of psychosocial variables, BUT...the ones that exist are quite ok and do their job
- - Unreliable status in terms of competition, who else is is using and publishing in the same area?
- An undetected gold-mine for ageing researchers, in particular researchers interested in longitudinal data and comparative studies (understanding heterogenity)

Change

- Change, and in particular within-person change, is very relevant to study, and is at the heart of the theories and models we use, but still very rarely examined (in an appropriate way…)
- Change is messy to interpret and understand and often a very heterogenous process. Need to use analytical tools accordingly, for example LGCM, GMM, and MLM
- Understanding change, predictors/determinants of change, moderators and mediators of change, and relationships of change is central for applied work and for developing effective interventions

Weaknesses associated with traditional or typical analyses of change

- They are conducted on variable (manifest) level, thereby mixing unrelated sources of variances (noise) with true change score and effects
- They do not test different competing hypotheses in terms of mutual causality and relationships across time
- They describe mean trajectories but not individual differences (heterogenity) in these trajectories
- They focus on between-person differences and not within-person change
- They are not able to evaluate complex coupling effects between variables across time (e.g., is true change in variable X related to true change in variable Y?

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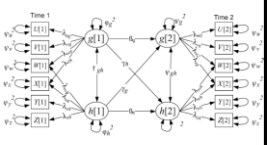
Cross-lagged models with latent variables

- Examine reciprocal relationships across time
- Control (adjust) for values at T1 in the same model
- Model measurement error, resulting in stronger true effects
- However, only capture between-person change and not within-person change, gives a limited picture of change



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The Reciprocal Relationship Between Physical Activity and Depression in Older European Adults: A Prospective Cross-Lagged Panel Design Using SHARE Data

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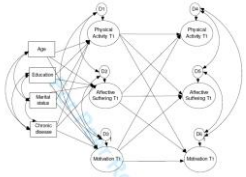

Figure 1. Specification of the tested cross-lagged structural model. The measurement models are not shown.

- 17.593 older adults (M=64 year) from 11 countries, second wave SHARE

-A cross-lagged model fitted data best, supporting a reciprocal relationship between depression and physical activity

- Regular physical activity may prevent future depressive symptom, and depressive symtoms may prevent older adults from engaging in regular physical activity

CHANGE IN PHYSICAL ACTIVITIES AND COGNITIVE FUNCTION

Aims

- Investigate the relationship between latent changes, across three occasions and 6 years, in physical activity (PA) and cognitive function (CF) in older European adults included in the Survey of Health, Ageing and Retirement in Europe (SHARE) database
- Examine age, gender and education differences in the PA-CF latent change relationships

Method
Sample

- 9 323 older men and women (Mage =62.88, SD =8.54) from 11 European countries included in the Survey of Health, Ageing and Retirement in Europe (SHARE) database.
- Only participants who completed all three waves of data in terms of PA and CF were included in the analyses

Method
Measures

• CF

- A general measure of CF was created by combining the scores of two tests:
- delayed memory (5 mins delayed recall from previous verbal learning recall task),
- verbal fluency (number of animals named in a one-minute trial).

• PA

- A general measure of PA was created by combining:
- frequency of moderate physical activity (gardening, cleaning the car, doing a walk)
- frequency of vigorous physical activity (sports, heavy housework, a job involving physical labour)

Method
Moderating variables

- Age was divided into three groups:
  -50-59 (n=3774),
  - 60-69 (n=3375), and
  - 70+ (70-92) (n=1826)
- Education, based on the ISCED97 code, was also divided into three groups:

-no or only primary education (n=4497),

-completed secondary education (n=2612), and

-tertiary, at least one degree, education (n=2214)

- Gender, men (n=4178), women (n=5145)

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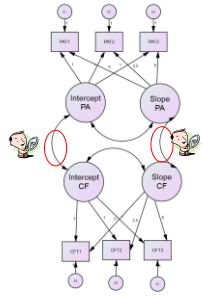
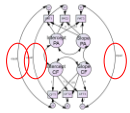
Method
Analyses

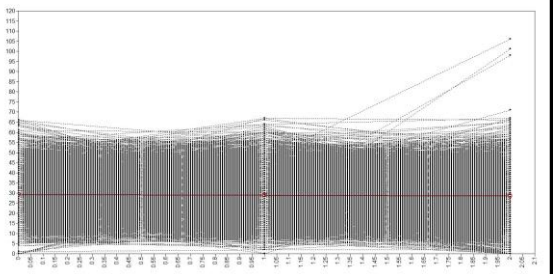
- Parallell process three-wave latent growth curve models were fit to data using Mplus, focusing on latent (measurement-free) constructs
- Associations of intercepts, slopes (correlated change) and residuals (state-like fluctuations) in CF and PA were estimated.
- The change associations were compared across gender, age and education groups.

The Parallell Latent Growth Curve Model

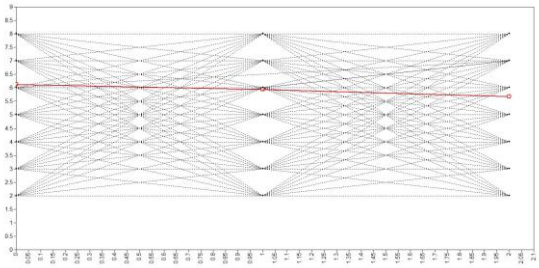




Cognitive function: The spaghetti plot



Physical activity: The spaghetti plot



Cognitive function change

	Intercept Mean (SE)	Slope Mean (SE)	Intercept Variance (SE)	Slope Variance (SE)
Full sample	29.29 (0.09)	-0.12 (0.01)	60.01 (1.29)	0.39 (0.06)
Gender				
Men	29.25 (0.13)	-0.15 (0.01)	56.00 (1.85)	0.40 (0.10)
Women	29.33 (0.13)	-0.11 (0.02).	63.22 (1.78)	0.37 (0.09)
Education				
None or Primary	25.31 (0.12)	-0.16 (0.02)	52.98 (1.62)	0.41 (0.08)
Secondary	31.13 (0.15)	-0.13 (0.03)	37.75 (1.91)	0.47 (0.11)
Tertiary	34.69 (0.16)	-0.05 (0.03)	38.62 (2.18)	0.23 (0.14)
Age				
50-59	31.51 (0.14)	0.09 (0.02)	53.10(1.92)	0.29 (0.10)
60-69	29.15 (0.15)	-0.15 (0.02)	60.29 (2.17)	0.47 (0.10)
70+	25.96 (0.19)	-0.42 (0.03)	51.01 (2.52)	0.54 (0.13)

- •CF declines (negative slope) in the full sample and all subgroups, except for in the youngest age-group
- •Larger decline in oldest age group, lowest education group and men
- •Significant variance for both intercept and slope = between-person differences in starting point and within-person change

Physical activity change

	Intercept Mean (SE)	Slope Mean (SE)	Intercept Variance (SE)	Slope Variance (SE)
Full sample	6.13 (0.02)	-0.07 (0.00)	1.75 (0.06)	0.02 (0.003)
Gender				
Men	6.35 (0.03)	-0.06 (0.01)	1.56 (0.08)	0.02 (0.005)
Women	5.96 (0.02)	-0.07 (0.01)	1.83 (0.08)	0.03 (0.005)
Education				
None or Primary	5.84 (0.03)	-0.09 (0.01)	1.97 (0.09)	0.03 (0.005)
Secondary	6.33 (0.03)	-0.07 (0.01)	1.52 (0.10)	0.02 (0.006)
Tertiary	6.44 (0.03)	-0.05 (0.01)	1.42 (0.10)	0.01 (0.006)
Age				
50-59	6.35 (0.03)	-0.02 (0.01)	1.51 (0.08)	0.02 (0.005)
60-69	6.20 (0.03)	-0.07 (0.01)	1.59 (0.09)	0.02 (0.006)
70+	5.74 (0.04)	-0.13 (0.01)	2.06 (0.14)	0.02 (0.008)

Note: *: p<.001

- •PA declines in the full sample and in all subgroups.
- •Larger declines in oldest agegroup and lowest education group.
- •Significant variance for both intercept and slope = between-person differences in starting point and within-person change

Results: PA-CF change associations

	PA – CF Intercept correlation	PA- CF slope correlation	PA-CF residuals correlation
Full sample	.36*	.36*	.06*
Gender			
Men	.31*	.56*	.03
Women	.40*	.26*	.08*
Education			
None or Primary	.37*	.31*	.10*
Secondary	.22*	.35*	.03
Tertiary	.27*	.56*	.03
Age			
50-59	.31*	.17	.02
60-69	.28*	.20*	.07*
70+	.37*	.46*	.10*

Note: *: p<.001

- A significant and positive correlation (r=.36, p<.001) between latent change (slope) in PA and CF for the full sample.
- Weak but significant correlations between occasion-specific deviations (residuals)
- Stronger slope correlations in men, the highest education group and the oldest age group
- Stronger residual correlations in women, the lowest education group and the oldest age group

Discussion

- Changes in PA and CF over 6 years were positively associated, both on a between-person and within-person level.
- Persons who declined more in PA (compared to the average) also declined more in CF, and vice versa
- On each occasion, if an individual was more active than expected, he/she also had higher CF than expected (given his/her own curve)
- Correlated change (slopes) stronger among men, higher education group and oldest age group, BUT..
- Correlations between state-like fluctuations (residuals) stronger among women, lowest education and the oldest

Limitations

- Broad and general (rough) self-report measure of PA, mixing information on frequency and intensity
- Limited variance in PA!?
- Invariance across time?
- Effect of attrition on change associations?

From a broader perspective…

- Dedifferentiation? Behaviours and function converging in old age?
- Associations on between- .vs within-person levels. Are they the same?
- Questions regarding cause and effect still unclear. Do changes in PA drive changes in CF or vice versa, or reciprocal model?

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Patterns of Heterogenity in Cognitive Change: Growth Mixture Model Analyses in Nine European Samples

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IALSA: Integrative Analysis of Longitudinal Studies on Aging (www.ialsa.org/)

- The IALSA collaborative network was formally established in 2005 for the coordination of interdisciplinary, cross-national research aimed at the integrative understanding of within-person aging-related changes in cognitive and physical capabilities, health, personality, and well-being. It is comprised of investigators associated with over 45 longitudinal studies on aging
- Primary goal: To facilitate new longitudinal research in ways that permit direct comparison of findings and cumulative knowledge from a within-person perspective

Integrative Analysis of Longitudinal Studies on Aging (IALSA)

An Evaluation of Analytical Approaches for Understanding Change in Cognition in the Context of Aging and Health

Integrative Data Analysis Through Coordination of Measurement and Analysis Protocol Across Independent Longitudinal Studies

Aim

- Identify patterns of trajectories in cognitive change across seven years using growth mixture models in nine European samples included in the SHARE study
- Conduct a replication study of heterogenity patterns of cognitive change in nine separate subsamples within a larger harmonized study (SHARE)
- Examine patterns of heterogenity in heterogenity in cognitive change

Method
Samples

- The nine samples were included in the Survey of Health, Ageing and Retirement in Europe (SHARE) database
- Sample sizes varied from 590 to 1,774 in the nine country-specific subsamples (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, and Belgium)
- Included participants completed three measures of cognition across seven years
- Mean age in the total sample (N=9,449) were 62.88 (SD=8.54)

Method
Measures

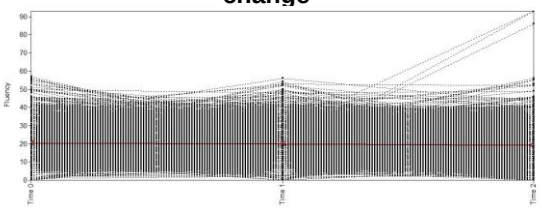
- Cognition: Verbal fluency

Participants were instructed to name as many animals as they could in 60 seconds. Scores were calculated as the sum of acceptable animals named.

Method
Analyses

- Person-centered analyses (growth mixture analysis, GMM) releases the assumption of homogenity and that data come from one population
- Separate GMM (using Mplus) were run for each of the nine different European countries in order to identify groups of older adults with similar trajectories (latent classes)
- Age, gender, education and physical activity used as covariates of level (intercept) and change (slope) of cognition within classes as well as predictors of class probabiliby (not reported here though)

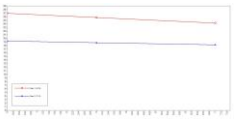
Results:
The spagetti plot of cognitive change



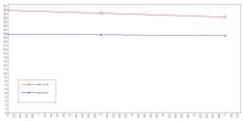
Intercept: Mean: 21.56 (0.11); Variance: 26.72 (0.74)
Slope: Mean: -0.15 (0.02); Variance: 0.10 (0.03)

Evident between person heterogenity in within-person change exist. How many latent subgroups hide in the data?

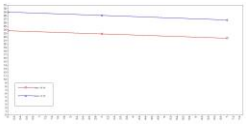
Results
Heterogenity in patterns (for 2 class solution)



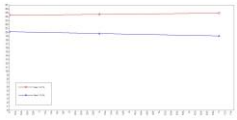
Austria



Germany



Sweden



Netherlands

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Results:
Heterogenity in patterns?

Samples	Class 1 Intercept	Class 1 Slope	Class 2 intercept	Class 2 Slope
Austria	20.50	-0.19*	26.02	-0.57
Germany	21.72	-0.11	28.50	-0.89*
Sweden	*25.30*	*-0.29**	*28.24*	*-0.29**
Netherlands	*20.24*	*-0.15**	*25.03*	*-0.11*
Spain	15.75	-0.20*	19.62	1.86
Italy	14.38	0.03	17.42	-0.06
France	19.85	-0.20	26.54	-0.67*
Denmark	21.48	-0.04	24.55	-0.06
Belgium	*20.04*	*-0.14**	*24.58*	*-0.04*

One majorty class with lower intercept and less change/more stability, and one minority class with higher intercept and decline. Samples in italics go against the trend (in terms of slope)

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Conclusions

- SHARE subsamples represent both substantial homogenity and heterogenity (and homogenity in heterogenity) in terms of cognitive trajectories
- Person-centered analysis may offer a valuable tool to dig deeper into heterogenity of data from a within-person perspective
- Replication studies of longitudinal findings important
- From a broader view, heterogenity may hide important information (not just unwanted noise), both from a scientific as well as a practical/applied perspective
- How mean is the mean? (see Speelman & McGann, 2013)

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