Dynamic relations among depressive symptoms and functional health in the Swiss Longitudinal Study on the Oldest Old [1]

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Theory. Changes in depressive symptoms and functional health are known to be essential parts of the quality of life and survival of the elderly and markers of the transition from young old age to old old age (or fourth age) (Baltes & Smith, 2003), from independence to frailty (Ghisletta, Girardin & Guillet, in press). Concerning normal aging, the most common trajectory is a general decline of functional health (see Lalive d'Epinay, Pin & Spini, 2001). The general finding for depressive symptoms is stability into very old age (Haynie et al., 2000).

The possible causal relationship between these two chief life factors is still questioned with studies showing longitudinally -and taking into account other possible confounding variables- an effect of functional health on depressive symptoms, the inverse relationship and even a possible synchronicity of decline in these two dimensions of health (Cronin-Stubbs et al., 2000; Mehta, Yaffe, Covinsky, 2002; Penninx et al., 1996; Ormell et al., 1993).

Research questions

a) Is the number of **depressive symptoms** stable longitudinally?

b) At what pace does **functional health** decline in very old age ?

c) What is the **direction** of the relationship between changes in functional health and changes in depressive symptoms?

SWILSO-O is a longitudinal study involving two cohorts. Only the first cohort (1910-1914) is considered here. A community-dwelling sample at baseline: 340 participants aged 80-84 years old, living at home. This sample was followed across nine waves (1994 to present) with face-to-face interviews at home or in institutions, with self-reports (proxies reports are not used here). Only the first five waves are analyzed here. The sample was stratified by gender and region (cantons of Geneva and Central Valais).

Measures: (1) Wang Self-Assessed Depression Scale (Wang, Treul & Alverno, 1975) ranges from 0 (no depressive symptom) to 10 (all depressive symptoms). (2) Functional Health (Katz et al., 1970; Lawton & Brady, 1969) ranges from 0 (no incapacities, independence) to 16 (maximum number of incapacities, dependence). Items concerne mobility (e. g., walking 200 meters) and basic activities (e. g., dressing, eating, etc.).

Variables in the models are standardized T-scores (mean=50, SD=10)

Description of analyses. Two steps were used in order to evaluate the trajectories (level and slope) in depressive symptoms and functional health (McArdle, 2001; McArdle & Hamagami, 2001; Ghisletta & Lindenberger, in press) and their reciprocal effects.

•A bivariate latent growth model (BLGM) was applied to test the static relationships between the two variables.

$$Y_{t,i} = Y_{t-1,i} + Sy_i + Ey_i \qquad \text{and} \qquad X_{t,i} = X_{t-1,i} + Sx + Ex_i$$

With $Y_{t-1,i}$ representing the score at t-1, Sy_i the slope of the variable y for individual i and Ey_i the associated error term. In this model, we are especially interested in evaluating the mean and the slope of depressive symptoms and functional health simultaneously.

•Bivariate dual change score models (BDCSM) were used to test the bivariate relationship between depressive symptoms and functional health. Here the structural equation can be defined as:

$$Y_{t,i} = (1 + \beta y)Y_{t-1,i} + \gamma_{x \to y}X_{t-1,i} + Sy_i + Ey_i \quad \text{and} \quad X_{t,i} = (1 + \beta x)X_{t-1,i} + \gamma_{y \to x}Y_{t-1,i} + Sx + Ex_i$$

In which γ is the parameter estimating the effects of the variations of one variable on the change of the other, while β estimates the effect of a variable on its own change. Sixteen models corresponding to all alternative dynamic specifications, with γs and βs fixed to 0 (no effect) or estimated, were computed. Notice that the model with all b = 0 and g = 0 is the BLGM model.

Results. Results of the BLGM and of the BDCSM are presented in the following table

	Bivariate latent growth model (BLGM)		Bivariate dual change score model (BDCSM)	
	Depressive symptoms	Functional incapacities	Depressive symptoms	Functional incapacities
Mean level	49.90	46.71	50.35	50.32
Mean slope	0.02	1.13	-0.10	160.01
SD level	10.16	7.02	8.13	13.44
SD slope	1.43	1.90	0.25	40.59
Correlation level-slope	-0.63	-0.18	-0.34	0.26
SD error	5.35	6.67	5.95	6.06
β	-	-	-	-0.26
γ	-	-	-4.91	-
-2LL (Restricted ML)	13853.39		13829.72	

Discussion. Results indicate that, as expected, there is an increase of 1.13 in the number of incapacities per year while the number of depressive symptoms remains stable across time (0.02). There are however large individual differences, both in level and slope of both depression and functional health. The BDCSM best fitting model is the one specifying a negative effect (-0.26) of the measure of functional health on its own change and an important negative effect (-4.91) of depressive symptoms on the change in the number of incapacities. As this model was the best-fitting model, this means that models including the inverse effect (effect of changes in functional health on change in depressive symptoms) did not fit as well to the data. This results is very important as it suggests that variations in depressive symptoms may have a unique causal effect (actually the γ for depressive symptoms was more than 6 times stronger than the γ for functional health, *model not reported here*) on changes in functional health, while depressive symptoms would be independent from variations in functional health.
These results indicate that psychological factors such as depression may exert strong effects on more physical dimensions of health. Moreover, they speak to the importance of diagnosing accurately and soon enough depression and other affect-related conditions in the elderly.