The Disability Paradox? Trajectories of Well-Being in Older Adults With Functional Decline

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Abstract

Objectives: The ‘disability paradox’ (DP) suggests that most older adults maintain subjective well-being (SWB) despite functional decline. However, this may depend the SWB component: positive affect (PA), negative/depressed affect (NA/DA) or life satisfaction (LS). We assessed trajectories of these components in older adults with substantial functional decline. Methods: Data originated from the Longitudinal Aging Study Amsterdam (N = 2545) observed during 1992–2008. Using latent class growth analysis, we distinguished a group with substantial functional decline and examined their SWB trajectories and individual characteristics. Results: The DP occurred more frequently for DA (Men:73%, Women:77%) and LS (Men:14%, Women:83%) than for PA (Men:26%, Women:17%). Higher perceived control (mastery) emerged as the most consistent factor associated with higher odds of the DP. Discussion: We provide a nuanced view of the DP, shifting the question from whether it exists to for which dimension of SWB and for whom it is more or less apparent.

Keywords

aging, physical functioning, longitudinal, positive affect, negative affect

Introduction

‘Why do people with serious and persistent disabilities report that they experience a good or excellent quality of life when to most external observers these people seem to live an undesirable daily existence?’ This phenomenon was first described by Albrecht and Devlieger (1999) and was referred to as the “disability paradox” (DP). About three percent of people aged 55 years and older and almost sixty percent of people older than 85 years have severe functional limitations (van Groenou & Deeg, 2006). Functional limitations are defined as the extent to which a person experiences limitations in carrying out the activities of daily living such as climbing up and down a staircase, dressing and undressing or walking. Given the aging population, increasing numbers of people live with some kind of functional disability. Moreover, while it may intuitively make sense to expect that maintaining subjective wellbeing (SWB) becomes increasingly difficult when facing age-related losses, the DP suggests otherwise (Kunzmann et al., 2000; Whitbourne & Sneed, 2002). Therefore it is important to consider the DP in the context of aging.

Different theories have been postulated that might explain this paradox. For example, the ‘discounting theory’ suggests that future-oriented coping might play a role. Older adults may actively construct representations of the future that are consistent with normative age-related declines and losses. Once these declines and losses actually occur, these expectations may reduce their potentially negative psychological effects (Cheng et al., 2009). This theory fits within the broader framework of selection, optimization, and compensation (SOC). SOC posits that aging is associated with proactive structuring of people’s lives to maximize fulfillment of fewer, yet more subjectively important goals (Freund & Baltes, 1998). Also in line with this...
framework is the social production function theory of successful aging (SPF). This theory specifies three key goals that determine overall wellbeing and tend to change in importance as people age (Steverink et al., 1998). First, status, or what someone “has”, is gained by attaining a higher position in social hierarchies, such as educational and occupational hierarchies. Second, behavioral confirmation stems from what someone “does”, and is mainly gained through social activities. Third, affection is the feeling that others care about you (Steverink et al., 1998).

With aging, status tends to decline first, for example as a result of retirement. The relevance of these theories to the DP is that decline of physical functioning often accompanies declines in status and, subsequently, behavioral confirmation. However, in response, older adults can increasingly shift their attention and efforts towards affection, for example through intensifying emotionally rewarding social contacts. As such, they balance gains and losses and maintain wellbeing despite functional decline.

Nevertheless, the existence of the DP in old age has been put into question (Cabrita et al., 2017; Gana et al., 2015; Jonker et al., 2008). Specifically, it has been argued that the presence of the DP depends on: (a) the SWB dimension under investigation, (b) the research design, and (c) individuals’ demographic psychosocial characteristics. We elaborate on these three issues.

First, concerning the issue of dimensionality, subjective well-being (SWB) is a broad concept comprising both a cognitive component (life satisfaction; LS), and an affective component, which is usually further subdivided into positive affect (PA; e.g., happiness, engagement, and joy) and negative affect (NA; e.g., worry, fear, uneasiness). NA is sometimes referred to as ‘depressed affect’, when it is operationalized using subscales from depressive symptomatology questionnaires (Hertzog et al., 1990). This conceptualization of SWB by Diener was recently supported by a meta-analysis that demonstrated that PA, NA and LS were unique dimensions with substantial loadings on a latent SWB factor (Busseri, 2018). These factor loadings did not vary significantly as a function of sample characteristics.

However, the intensity and speed of change over time may differ between SWB indicators. Originally, it was argued that the cognitive component (LS) is more stable than the affective component (NA and PA; Gana et al., 2015; Puvill et al., 2016). Indeed, various studies show that life satisfaction is remarkably stable over time (e.g., Fujita & Diener, 2005; Gana et al., 2012), and other studies demonstrate that PA tends to decrease and NA tends to increase with advancing age (e.g., Griffin et al., 2006). Kunzmann and colleagues (2008) focused only on the affective components of SWB, and found that NA was more stable over time than PA. Reasons why the cognitive component would be more stable than the affective component mainly include methodological ones: LS is often asked with a single question about a very broad circumstance (satisfaction with life in general), whereas questionnaires on PA and NA consider a shorter time frame and appear to be more sensitive to daily hassles and events (Gana et al., 2015; Hansen & Slagsvold, 2012). Nevertheless, one of the few studies that could directly compare longitudinal changes across both cognitive and affective dimensions found PA to be the most stable, while LS decreased and NA increased (Hansen & Slagsvold, 2012).

The authors of that study argue that the stability of PA could be due to improving emotion regulation skills with age (Carstensen et al., 1999). Given the conflicting evidence on the stability of SWB components and the implications of this for the DP, the current study includes longitudinal trajectories of LS, NA and PA.

Second, concerning issues of study design, most studies describing the DP have treated their sample as a single homogeneous group rather than considering whether differential trajectories of decline in functioning and/or well-being are present. This can be problematic, because in the general older population, substantial groups do not display functional decline until high ages. For example, Kok and colleagues (2017) observed different types of trajectories of functional limitations in older men and women, and found that 68% of men and 54% of women aged 55 and older showed no functional decline across 16 years of time. We argue that such groups should be excluded before examining the DP, because it can by definition not be observed in older adults without functional decline. Therefore, in the present study we use data-driven methods to distinguish a group of older adults with substantial functional decline over a 16-year period.

Furthermore, given that there is substantial heterogeneity between older adults in their trajectories of SWB (Fujita & Diener, 2005; Gana et al., 2012; Griffin et al., 2006; Hansen & Slagsvold, 2012), it may be too simplistic to draw conclusions about the DP based on the average (change in) SWB. Furthermore, focusing on trajectories rather than cross-sectional observations of functional limitations and SWB is important because a recent review by Cabrita and colleagues (2017) demonstrated that only the longitudinal studies included (n = 4, spanning 4 months and 2, 4, and 6 years respectively) provided consistent evidence that higher SWB was associated with fewer functional limitations. Therefore, besides focusing on older adults with substantial functional decline, within this group we identify subgroups with distinct types of SWB trajectories.

Functional decline trajectories and SWB trajectories may also differ by gender. For example, Doblhammer and Hoffmann (2009) find that women live longer with functional limitations. In line with this, in the same dataset as used in the present study (Kok et al., 2017), we previously found that men more often had a stable high physical functioning trajectory than women (68 versus 54%), and that 5.5% of women had a stable low functioning trajectory whereas none of the men had this type of trajectory. Concerning SWB, the same study found that only in women (9%) a distinct
subgroup with stable high depressive symptoms could be identified, although percentages with stable high LS were about equal (89% in men versus 83% in women; Kok et al., 2017). To allow for observing potential gender differences in the DP, we therefore analyze functional and SWB trajectories separately for men and women.

Third, the extent to which the disability paradox is evident may vary according to psychosocial and demographic factors. For example, higher socio-economic status, being married, and psychological characteristics such as high perceived control and self-esteem have been shown to help maintain SWB despite functional decline (Fellinghauer et al., 2012; Jonker et al., 2008). Personality traits are thought to affect well-being by influencing emotional reactivity and by facilitating adaptation following challenging life events, such as the onset of impairments (Lucas & Diener, 2015). In addition, older individuals with high levels of self-efficacy (i.e., the belief of a person in his or her ability to organize and execute behaviors necessary to produce desired attainments) are less likely to perceive limitations in daily activities and more likely to report higher levels of SWB (Seeman et al., 1999). Because such constructs fit well within the SOC, SPF and discounting theories, in the present study we also investigate whether various demographic and psychosocial characteristics are associated with the DP.

Building on these conceptual and methodological considerations, and expanding the available literature, the current study examines the prevalence and associated psychosocial factors of the DP in people aged 55 years and older who experienced substantial functional decline over a 16-year period. We take into account the multidimensionality of SWB by examining trajectories separately for PA, NA and LS, and separately for men and women. Given that physical functioning and SWB are not strongly correlated and that some studies demonstrate declines of SWB components with ageing, we hypothesize that within the population of older adults with functional decline several subgroups exist; groups who maintain stable levels of well-being, supporting the DP, and groups who decline in well-being over time, contradicting the DP. Regarding the different components of SWB, because most empirical evidence suggests life satisfaction has the strongest stability over time, we hypothesize that the DP is more clearly present for the cognitive component of SWB (LS) than for the affective components of SWB (PA and NA).

Methods

Study Sample

We used data from the Longitudinal Aging Study Amsterdam (LASA). The study is based on a nationally representative sample of adults aged 55–84 years at baseline (years of birth 1908–37). The baseline data collection was conducted in 1992–1993, with three to four-yearly follow-up measurements. The baseline measurement included 3107 respondents. Follow-up measurements were carried out in 1995–1996 (N = 2545), 1998–1999 (N = 2076), 2001–2002 (N = 1691), 2005–2006 (N = 1257) and in 2008–2009 (N = 985). We included only participants with valid data for functional limitations on at least the first two measurement waves (N = 2537), in order to capture within-person change. More details on the LASA-study can be found elsewhere (Huisman et al., 2011). Written informed consent was obtained from all respondents, and the study was approved by the Medical Ethics Committee of the VU University Medical Center and conducted according to the principles of the Helsinki declaration.

Measures

Functional Limitations. We used a scale based on six items derived from the Organization for Economic Co-operation and Development (OECD) questionnaire (McWhinnie, 1981). The items measured the extent to which a participant experienced limitations in carrying out the following Activities of Daily Living (ADLs) and instrumental ADLs. In pilot studies prior to the start of the first LASA cycle, using iterative elimination, the item with the lowest item-rest correlation was omitted until three items were left (Smits et al., 1997). These were: climbing up and down a staircase of 15 steps without stopping, cutting own toenails, and using own or public transportation. By the second LASA cycle, it was nevertheless decided to add three items that were also available from a study conducted in the same participants one year before the LASA baseline, the NESTOR-LSN study (https://www.lasa-vu.nl/data/lsn/lsn.htm). These items were: walking for five minutes outdoors without resting, getting up from and sitting down in a chair, and dressing and undressing. As such, we were able to include all six items from each measurement wave. The response categories ranged from 1 (“yes, without difficulty”) to 5 (“no, I cannot”). Scores were reversed and then summed, so that a higher score reflects fewer functional limitations (range 6–30).

Subjective Well-Being

The affective component of SWB was measured by the positive affect and depressed affect dimensions of the Centre for Epidemiological Studies-Depression scale (CES-D) (Radloff, 1977). The CES-D has good psychometric properties in samples of older adults (Hertzog et al., 1990). The subscale positive affect includes four items such as enjoying life, feeling happy, being hopeful about the future and feeling as good as other people. The subscale depressed affect (DA) includes seven items such as feeling blue, sad,lonely, and failure. Because we used this specific subscale to measure Negative Affect, we refer in the methods and results sections to this aspect of SWB as ‘Depressed Affect’. The response categories ranged from ‘rarely or never’ (score of 0) to ‘mostly or always’ (score of 3). We averaged scores of the
items and rescaled them to a range of 0–30 to make the PA and DA range more comparable to functional limitations. To assess the cognitive component we included life satisfaction (LS), measured by the question: ‘How satisfied have you been with your life lately?’ The response categories ranged from 1 (very dissatisfied) to 5 (very satisfied). We multiplied the score by 6 to make the LS range more comparable to functional limitations.

**Baseline Characteristics**

**Demographic Factors.** Age (continuous), sex (0 = male; 1 = female), years of education (continuous), and income (continuous) were included. The highest level of education achieved was asked in nine categories and then recoded to years of education needed for that level (range 5 (elementary school) to 18 (college and university)). Net monthly household income, including partner’s income, was asked in 12 categories, which we transformed into a continuous variable by recoding each category to its median value. Because income had relatively many missing values (359), we used observations from later measurement waves for missing baseline values, after applying an inflation correction. This reduced the number of missing values to 99. Remaining missing values were treated using multiple imputation – see analytical procedure.

**Psychological Factors**

*Mastery* reflects the extent to which one feels that the course of one’s life is under one’s own control, as opposed to being determined by external forces or fate. It was measured by a five-item version of the Pearlin Mastery Scale (Pearlin & Schooler, 1978), ranging from 5 to 25. We could not identify specific validation studies of this scale in older adults. However, mastery does not strongly decline with age and has been shown to be adaptive with regards to age-related challenges such as cognitive decline and recovery from illness (Lachman et al., 2011). *Self-efficacy* reflects one’s evaluation of the ability to attain goals. It was measured by a 12-item version of the General Self Efficacy Scale with a range of 12–60. The scale covers three dimensions: willingness to initiate behavior directed towards personal goals, willingness to expend effort to complete such initiated behaviors, and persistence in the face of adversity, that can also be applied as a total scale (Sherer et al., 1982). Cross-cultural robustness of the factor structure (Scholz et al., 2002) and the validity of the total score in an older population has been demonstrated (Bosscher & Smit, 1998).

**Cognitive Functioning**

Cognitive functioning was measured by the Mini Mental State Examination (MMSE), a screening instrument to assess global cognitive functioning, covering domains such as orientation in time and place, episodic memory, attention and calculation (Folstein et al., 1975). The scores vary between 0 (all answers incorrect) to 30 (all answers correct).

**Social Factors**

We included partner status, coded as having a partner living inside the household (1) versus no partner or a partner living outside the household (0). We included social network size, based on the question “name the people aged 18 years and older you have frequent contact with and who are also important to you” (range 0–76).

**Number of Chronic Diseases**

To measure somatic health we included a count of the number of self-reported presence of seven chronic diseases: chronic obstructive pulmonary diseases, cardiac disease, peripheral arterial disease, diabetes mellitus, cerebrovascular accidents, rheumatoid arthritis or osteoarthritis and cancer. These chronic diseases were asked as they were the most frequent in the Dutch older population with a prevalence of at least 5% at the time the LASA study commenced (van den Hoogen et al., 1987).

**Analytical Procedure**

The analytical procedure consisted of three steps. First, using Latent Class Growth Analysis (LCGA) (Nagin, 1999) in Mplus (version 7.1), we identified subgroups of older adults with distinct trajectories of functional limitations across 16 years. Through maximum likelihood estimation, LCGA allowed us to estimate full trajectories of all baseline participants even with incomplete follow-up data, thereby reducing survivor bias and aiding the choice of a cut-off point between no decline versus decline based on all available longitudinal data. Based on this analysis, we excluded the group with trajectories that showed no or minimal functional decline from further analysis, as the potential DP cannot apply to them.

Second, in the group with substantial functional decline, we again used LCGA’s to identify subgroups with distinct trajectories of PA, DA and LS, respectively. We regarded subgroups in whom SWB did not decline as having a trajectory “in support of the DP”, while we regarded subgroups with declining SWB as having a trajectory “contradicting the DP”.

Third, we compared demographic and psychosocial characteristics between DP and non-DP subgroups. All analyses were conducted separately for men and women. We excluded participants who had less than two measurements of SWB (n = 11).

LCGA uses a statistical algorithm to identify subgroups by maximizing differences between and minimizing differences within subgroups. The LCGA assumes no variance within
groups. Determining the number of subgroups and their trajectories is an iterative process. We repeatedly fitted an additional subgroup to the data and compared model fit statistics to the previous model with one class less to determine the optimal number of subgroups. Optimal fit was determined on the basis of: lower sample size adjusted Bayesian Information Criterion (SSA-BIC), the Likelihood Ratio Test (LRT) \((p\text{-value } < .05 \text{ indicates that the present number of classes fits better than a model with one class less})\), smallest latent class contains \(\geq 5\%\) of the sample, and interpretability (Muthén, 2003). Further, we report the entropy statistic \((\text{range } 0–1)\), which indicates the amount of statistical uncertainty in classification; values closer to 1 indicate less uncertainty.

We completed this process with linear slopes and quadratic slopes and then decided on the optimal growth parameter by comparing BIC values between them. Furthermore, because of highly skewed distributions, for functional limitations (left-skewed), PA (left-skewed) and DA (right-skewed), we used censored models that accounted for the ceiling and floor effects. After deciding on the optimal number of subgroups and their growth parameters, variables expressing the classes with the highest posterior probability for each participant were exported to SPSS v22 for further analysis.

For describing differences in baseline characteristics between men and women in the total sample, we used F-tests and Chi-square tests. Since 214 of the 2534 respondents had missing values on one or more of the baseline characteristics (Income, Partner status, MMSE, Mastery and Self-efficacy; 8.3\% of our sample), we applied Multiple Imputation with 20 imputed datasets. To estimate associations between baseline characteristics and the relative odds of having a trajectory that was in line with the DP (i.e. no SWB decline despite functional decline), we used logistic regression analysis in which all baseline characteristics were entered simultaneously as predictors.

## Results

### Descriptive Statistics

Our analytical sample contained 2534 respondents, the average baseline age was 69.1 and 53.4\% was female. The men in our sample had more years of education, higher income and more often a partner in their household than the women. The women had more chronic diseases, more functional limitations, lower positive affect and life satisfaction, mastery and self-efficacy scores, and higher depressed affect compared to the men (Table 1). Descriptive statistics after imputation were almost identical to the observed statistics (not shown in Table).

### Latent Class Growth Analysis of Functional Limitations

Model fit statistics indicated that for men and women, a four and six class model with a quadratic slope fitted best to the data, respectively (see Supplementary Table S1). Entropy values were 0.73 for men (posterior probabilities ranged between 0.72 and 0.78) and 0.64 for women (posterior probability range 0.64–0.87), indicating some uncertainty in classification.

The different trajectories of the LCGA for men and women can be found in Figure 1. We labelled the four trajectories of functioning for men as “High stable functioning”, “High functioning with some decline”, “High functioning with strong decline”, and “Medium functioning with strong decline” (Figure 1a). We refer to these trajectories as respectively “A” to “D”. The six trajectories for women were labeled “High stable functioning”, “High functioning with some decline”, “High functioning with very strong decline”, “Medium functioning with decline”, “Medium functioning with strong decline” and “Low functioning with early decline” (Figure 1b). We refer to these trajectories as “A” to “F” (arranged from high to low functioning).

The majority of men (66\%; trajectories A and B) and about half of the women (48\%; trajectories A and B) did not have limitations in physical functioning at the start of the study (see Figure 1a and b, grey lines (“High stable functioning”, “High functioning with some decline”), and showed less than 10\% decline. Therefore, we excluded these subgroups and combined the remaining subgroups for further analysis (i.e., trajectories C and D for men; \(n = 401\); and trajectories C-F for women; \(n = 696\)). On average, the men with functional decline experienced a 42\% decline in functioning, and the women a 39\% decline.

Given the relatively low entropy values of the LCGAs, we verified whether we accurately selected a group with substantial functional decline. We did this by examining how many of the respondents with functional decline could not perform at least one of the six (i) ADLs at the time of their last observation – even with help. This applied to 70\% of the men and 80\% of the women, whereas for the excluded trajectories this applied to only in 12\% and 18\% of the men and women, respectively. We accepted this as evidence for a reasonable distinction between older adults with and without functional decline. Baseline differences in characteristics between the groups with functional decline and no functional decline can be found in the Supplementary Table S2.

### Latent Class Growth Analysis of Subjective Well-Being

We restricted our LCGA of SWB to the group with substantial functional decline. The model fitting process is described in detail in Supplementary Table S3. Entropy values for the selected LCGA models for the three SWB components were .76 (positive affect), .65 (depressed affect) and .84 (life satisfaction) respectively for men (average posterior probability range 0.83–0.97) and .74, .72 and .62 for women.
(average posterior probability range 0.81–0.94), indicating some uncertainty in classification.

**Positive Affect**

We found two trajectories of PA for men and three for women (Figure 2a and 2b). The two trajectories in men converged to an almost similar level of PA at the end of the 16 year period. However, their origin was very different. A small subgroup (26%) had medium levels of PA at the start but showed increasing PA over time, in support of the DP. A large subgroup (74%) started with high PA, which decreased over time, contradicting the DP. Higher education was associated with higher odds of the DP trajectory, and having a partner,

| Demographics | Observed n | Men N = 1182 M (s.d)/ % | Women N = 1352 M (s.d)/ % | Difference between men and women |
|--------------|------------|--------------------------|--------------------------|---------------------------------|
| Age (55–84)  | 2534       | 69.0(8.6)                | 69.1(8.6)                | p = .67                         |
| Years of Education (5–18) | 2534 | 9.7(3.4)                | 8.2(3.0)                | P < .001                        |
| Partner in household (%) | 2531 | 79.3%                    | 52.7%                    | p < .001                        |
| Income (mean net euros per month) | 2435 | 1288(570)                | 968(495)                | p < .001                        |
| Health-related Factors | Observed n | Men N = 1182 M (s.d)/ % | Women N = 1352 M (s.d)/ % | Difference between men and women |
| Chronic diseases (0–7) | 2534 | 0.8(0.9)                | 1.0(1)                | p < .001                        |
| Functional limitations (6–30)a | 2404 | 28.5(3.2)                | 27.0(4.8)                | p < .001                        |
| Psychological Factors | Observed n | Men N = 1182 M (s.d)/ % | Women N = 1352 M (s.d)/ % | Difference between men and women |
| Cognitive Functioning (0–30)b | 2523 | 27.3(2.5)                | 27.2(2.7)                | p = .31                         |
| Positive Affect (0–30) | 2508 | 23.0(7.1)                | 21.4(7.5)                | p < .001                        |
| Depressed Affect (0–30) | 2531 | 1.5(3.1)                | 3.0(4.5)                | p < .001                        |
| Life Satisfaction (6-30) | 1938 | 23.8(3.3)                | 23.4(3.6)                | p = .01                         |
| Masteryb | 2465 | 17.6(3.3)                | 17.1(3.3)                | p < .001                        |
| Self-efficacyb | 2417 | 42.8(5.1)                | 41.3(5.4)                | p < .001                        |
| Network Size (0–76)b | 2411 | 14.1(8.4)                | 14.2(8.3)                | p = .92                         |

*ahigher score indicates fewer functional limitations.
bImputed M and SD were very similar compared to the original sample.

Figure 1. Trajectories of functional limitations over time (a) Men (b) Women, higher scores reflect fewer limitations.
larger network size and higher mastery were associated with lower odds (Table 2). Because these associations (except for education) were in the opposite direction of what we expected, we considered that this could be caused by the baseline level of PA being much lower in the DP trajectory than the non-DP trajectory. Therefore, we additionally adjusted for the baseline level of PA. After this adjustment, the associations were no longer statistically significant.

Figure 2. Trajectories of SWB (positive affect, depressed affect, life satisfaction) over time for men and women with functional decline, black lines indicate ‘no support of DP’, grey lines indicate ‘in support of DP’.

Table 2. Associations between demographic and psychosocial factors and the relative odds of demonstrating the disability paradox in men.

|                          | Disability Paradox PA “low increasing” n=399 | Disability Paradox DA “low stable” N=401 | Disability Paradox LS “medium stable” N=363 |
|--------------------------|-----------------------------------------------|------------------------------------------|---------------------------------------------|
|                          | OR 95% CI p                                   | OR 95% CI p                              | OR 95% CI p                                  |
| **Demographics**         |                                               |                                          |                                             |
| Age (55–84)              | 0.98 0.95–1.01 .21                            | 1.02 0.99–1.06 .22                       | 0.96 0.93–1.01 .09                          |
| Years of Education (5–18)| 1.10 1.00–1.20 .04                            | 0.99 0.91–1.08 .78                       | 1.05 0.93–1.17 .44                          |
| Partner in household (%) | 0.48 0.28–0.84 .01                            | 2.00 1.15–3.45 .01                       | 0.68 0.33–1.43 .31                          |
| Network Size (0–80)      | 0.92 0.88–0.97 .001                           | 1.04 0.99–0.98 .09                       | 0.96 0.91–1.01 .13                           |
| Income (100 net euros per month) | 1.01 0.92–1.10 .88       | 0.97 0.88–1.05 .42                       | 0.94 0.83–1.06 .28                          |
| **Health-related Factors** |                                               |                                          |                                             |
| Chronic diseases (0–7)   | 1.10 0.88–1.37 .40                            | 0.76 0.61–0.94 .01                       | 1.31 1.00–1.71 .05                          |
| **Psychological Factors** |                                               |                                          |                                             |
| MMSE score (0–30)        | 0.97 0.89–1.05 .44                            | 1.05 0.96–1.14 .26                       | 1.11 0.97–1.28 .13                          |
| Mastery (5–25)           | 0.90 0.82–0.98 .01                            | 1.18 1.09–1.29 <.001                     | 0.85 0.77–0.95 .01                          |
| Self-efficacy (12–60)    | 0.94 0.89–1.00 .06                            | 1.05 0.99–1.12 .10                       | 0.97 0.90–1.05 .49                          |
For women, two trajectories were in support of the DP; one subgroup had low but increasing PA (17%), and the other had stable moderate PA (33%). The largest subgroup (50%) displayed high PA at the start with a decline over time, contradicting the DP. More chronic diseases were associated with higher odds of the DP, whereas having a partner, higher mastery and higher self-efficacy were significantly associated with lower odds of the DP (Table 3). When adjusting for baseline PA, only the association for higher mastery remained significant.

**Depressed Affect**

We found two trajectories of DA for men and women (Figure 2c & d). For men, the largest subgroup (73%) had low DA at the start which remained stable, in support of the DP. The smallest subgroup (27%) displayed a clear increase in DA, contradicting the DP. More chronic diseases were associated with higher odds of the DP, whereas having a partner, higher mastery and higher self-efficacy were significantly associated with lower odds of the DP (Table 3). When adjusting for baseline DA, the association for higher mastery remained significant for women.

For women, both subgroups showed stable DA, although one group had a low level (77%) and another group showed a moderate level (23%). Because despite functional decline, DA in both groups remained stable, we evaluated both trajectories as being in support of the DP. Therefore, we did not calculate associations between baseline characteristics and the DP for women (Table 3).

**Life satisfaction**

We found two trajectories of LS for men and women (Figure 2e & f). For men, a small subgroup (14%) had moderate stable LS, in support of the DP. The other group (86%) started with high LS, but then showed decline, contradicting the DP. More chronic diseases were associated with higher odds of the DP, and higher mastery was associated with lower odds (Table 2). These associations were no longer significant after adjustment for baseline LS.

For women, there was also a large group that started with high LS (83%), but in this group LS remained stable, in support of the DP. The remaining subgroup (17%) had moderate LS at baseline and then decreased, contradicting the DP. Higher baseline age and higher mastery were associated with higher odds of the DP. After adjustment for baseline LS, associations for higher age and higher mastery remained significant.

**Sensitivity Analyses**

Finally, we checked whether participants with the worst functional decline trajectories were also more likely to experience declining SWB trajectories. This was not the case; Cramer’s V ranged between .11 and .18. We also tested to what extent the same participants ended up in the same trajectory for each dimension of SWB, and the overlap between SWB trajectories was moderate (Cramer’s V ranged between .26 and .44). Details can be found in the supplementary material.

**Discussion**

To our knowledge, our study is the first to examine the disability paradox based on long-term trajectories of multiple subjective wellbeing (SWB) dimensions in older adults with functional decline. Reasoning from the disability paradox, we...
adopting a stricter definition to PA, then we would conclude that no subgroups showed trajectories that support the disability paradox. For NA, the paradox would still apply to 73% of women, but only to 77% (instead of 100%) of men. For LS, the paradox would still apply to 83% of women and only 14% of the men. The disability paradox thus seems more prevalent in women than in men, yet for both genders there are substantial groups that experience decreases in SWB, contradicting the premise of the disability paradox.

However, our analyses revealed a tricky conceptual and methodological issue, which is that several subgroups already had low levels of wellbeing at the start of our observation, suggesting a limited scope for further deterioration of SWB. For interpreting our data, we operationalized the paradox as reflecting stable SWB despite functional decline, yet when adopting a stricter definition of the paradox as retaining high levels of wellbeing despite functional decline, these subgroups with stable low SWB would not support it. If we apply this stricter definition to PA, then we would conclude that no subgroups showed trajectories that support the disability paradox. For NA, the paradox would still apply to 73% of men, but only to 77% (instead of 100%) of women. For LS, the paradox would still apply to 83% of women but not (instead of 14%) to men. Concerning the role of psychosocial factors, we conclude that for NA in men, higher perceived control over life (mastery) was associated with higher odds of demonstrating the disability paradox, and for LS in women, higher baseline age and higher mastery were associated with higher odds of demonstrating the disability paradox.

**Subcomponents of SWB**

Sensitivity analyses showed that trajectories of LS, PA and NA had moderate overlap. This corroborates the idea that SWB comprises of only partly overlapping components, and emphasizes that research on the DP should distinguish these components. We hypothesized that the DP would be more clearly present for the cognitive component of SWB (life satisfaction) than for the affective components of SWB (positive affect and negative affect). Our data does not support this hypothesis, because we found the most consistent evidence for the paradox for NA, while it applied merely to women for LS. Our findings on PA, however, did support the idea that the paradox is less applicable to the affective component of SWB. In general, we conclude that NA and LS seem more alike in their stability over time, and that PA appears to be more prone to decline with increases in functional limitations.

This finding is opposite to the only other study we could find that compared all three indicators of SWB (Hansen & Slagsvold, 2012). These authors found a decline in LS and increase in NA, yet stability in PA. However, their analysis was based on a single five-year follow-up measurement, and did not focus on a subgroup with functional decline nor distinguished subgroups with distinct types of SWB trajectories. It is clear that replication of our findings should be attempted in other data and with similar methods. Furthermore, both Hansen & Slagsvold’s (2012) and our own studies suggest that the posited dichotomy between a “cognitive” and “affective” component of SWB is too simplistic. NA and PA seem to behave differently in old age.

These differences may be understood from theory that suggests that PA and NA serve different motivation systems (e.g., (Gable et al., 2000; Watson et al., 1999), and hence are driven by different susceptibilities to stimuli, depending on whether these reward the individual’s active behavior (PA) or signal threats and aversive experiences that negatively alter one’s self-evaluation (NA; e.g. (Vogel et al., 2013). Thus, PA is assumed to be ‘activity driven’ and refers to feelings about what one ‘does’ (Fredrickson, 2001; Watson et al., 1999). Social aspects such as inclusion in social life, maintaining contacts to friends and family, and maintaining participation in valued activities are considered important aspects of PA (Watson et al., 1999). Functional limitations clearly reflect individuals’ scope to engage in social or productive activities; hence it seems logical that for most participants, PA also tended to decline, contradicting the disability paradox. In contrast, NA reflects negative self-evaluations, or feelings about what or who one ‘is’. This is assumed to be more strongly driven by genetic susceptibility and negative (early) experiences during the life-course and less by specific health aggravations later in life (see e.g. Janssen et al., 2006). This is in line with the higher prevalence of the disability paradox for NA, compared to PA.

**Role of Psychosocial Resources**

Our analysis showed a number of demographic factors and psychosocial resources that were associated with the disability paradox. The most robust findings which remained after adjustment for differences in baseline SWB were on perceived control over life, or mastery. For NA and LS, older adults with higher mastery had higher odds of a stable low (NA) or high (LS) trajectory. Indeed, personality traits are thought to affect well-being by influencing emotional reactivity and by facilitating adaptation following challenging life events, such as the onset of impairments (Lucas & Diener, 2015). Additionally, psychological coping strategies have been shown to moderate the effect between declining health and well-being (Borg et al., 2006; Jonker et al., 2008). Furthermore, older individuals with high levels of self-efficacy are less likely to perceive limitations in daily
activities and also report higher levels of SWB (Seeman et al., 1999).

Nevertheless, for PA higher mastery was associated with lower odds of having a trajectory in line with the disability paradox, even after adjustment for baseline PA. Although counterintuitive, this finding might be understood from the discounting perspective (Cheng et al., 2009). When feeling relatively low control over life, normative age-related declines and losses, such as those expressed by functional limitations, may have less impact on SWB once they emerge. Our finding that higher baseline age was associated with the disability paradox for LS in women, also seems to be in line with the discounting perspective; older persons may more strongly anticipate functional declines to emerge, and therefore these declines may impact less strongly on SWB than for young-old adults.

We also evaluate our findings on the psychosocial factors from the Social Production Function theory of Successful Aging (SPF). According to SPF, status and behavioral confirmation relate positively to positive affect and negatively to negative affect, and behavioral confirmation and affection relate positively to life satisfaction (Steverink et al., 1998). An empirical study supported these expectations (Steverink & Lindenberg, 2006). Although we did not explicitly operationalize these resources, education and income can be seen as indicators of status, and partner status and social network size may partly reflect behavioral confirmation and affection. Although for some SWB components we found that higher education, having a partner and a larger network size were associated with higher odds of the disability paradox, these associations were no longer statistically significant after adjustment for baseline SWB. Therefore from a SPF perspective our findings do not support a role for these resources in explaining the disability paradox. Additional studies with a more direct operationalization of the SPF components are needed to evaluate its central tenets.

**Practical Implications**

The findings carry practical implications. First, for health care, a central message from our study is that older adults with functional decline do not seem to be at risk of increases in negative affect, and that the majority of women with functional decline retain high levels of life satisfaction. However, caregivers should not take the disability paradox for granted: positive emotions in both men and women, and life satisfaction in men do decline over time. This suggests that it is important to support older adults to seek new, gratifying activities that remain possible despite specific functional limitations. Second, for research our study pointed towards some challenges with regards to studying the disability paradox. Researchers should carefully consider that substantial groups of older adults may have low levels of wellbeing even while having few functional limitations; can the paradox apply to them? Given the large heterogeneity in physical function and wellbeing among older adults, it could be valuable if future studies examine in even more detail the within-individual dynamics between functional decline and SWB to explain the disability paradox and its associated factors.

**Strengths**

The strengths of our study are its longitudinal design spanning 16 years and multidimensional examination of SWB. In addition, we selected our respondents based on functional decline, because it can be argued that a DP cannot exist in individuals without functional decline. Moreover, we used contemporary statistical analysis to determine whether there were underlying classes of individuals whose SWB changes differentially across time. By relating trajectories to different factors such as demographics and mastery, we were able to link our results to different theories underlying the DP.

**Limitations**

First, older persons with ill health are under-represented in our sample, possibly leading to biased estimates of the prevalence of the DP. Nevertheless, we were able to examine a substantial group of older adults with functional impairments or decline in daily functioning, and handled missing follow-up data using maximum likelihood estimation.

Second, the entropy values of the latent class growth analyses indicated that there was some uncertainty in classifying individuals as having substantial functional decline. Furthermore, in describing differences in characteristics between SWB subgroups we used the Classify-Analyze approach, which does not take into account uncertainty of classification. However, sensitivity analyses confirmed that almost all participants in the final ‘functional decline’ group made a substantial transition to being limited in at least one activity of daily living, which in our view is sufficiently accurate for our purposes. Similarly, we believe that for the descriptive purposes of this study, presenting differences in characteristics between SWB subgroups based on a Classify-Analyze approach is sufficient and easier to interpret than when using regression-based approaches to adjust effects of covariates on latent class membership for classification uncertainty (Asparouhov & Muthén, 2014).

Third, we used subscales of the CES-D for positive (4 items) and depressed (7 items) affect. Previous studies used other measurement instruments, such as the Scale of Positive and Negative Experiences (SPANE; e.g. Busseri, 2018) and the Positive and Negative Affect Schedules (PANAS; e.g. Kunzmann et al., 2000). It has been argued that the CES-D includes valid subdimensions of positive and negative affect (Ranzijn & Luszcz, 2000), and the CES-D total score showed moderate to strong correlations (.37–.66) with PANAS dimensions (Terracciano et al., 2003). Yet we could not identify
studies directly comparing the validity of different instruments to measure PA and NA.

Fourth, we combined the functional decline groups to simplify our results and interpretation and to have enough statistical power for conducting the second LCGA on SWB dimensions. Yet, it would be interesting to examine in future research whether specific functional decline patterns, for example having a steady decline or a sudden drop in functioning matters for the relationship with well-being and the DP. Finally, items of the three SWB dimensions referred to different time frames, which may partly explain differences in their stability over time. For example, life satisfaction was based on “your life lately”, whereas the CES-D is based on “the past week” and also contains an item about being hopeful for the future. Yet, given our longitudinal design, we were able to capture potential changes over a period of sixteen years in these dimensions of SWB.

Conclusion

Despite limitations, these data offer intriguing findings on the relationship between functional decline and SWB and shed light on the DP. We observed that the DP is more frequently observed for negative affect and life satisfaction than for positive affect, and was more frequent in women. For PA (men and women) and LS (men) we did observe subgroups with stable wellbeing across 16 years despite functional decline, yet their overall level of wellbeing was relatively low. When restricting to groups that showed persistent high wellbeing despite functional decline, we identified a higher sense of control over life as the most robust predictor of the disability paradox. Although there is theoretical and empirical research suggesting that promotion of SWB can lead to improvement of functioning or delay of decline (Howell et al., 2007; Lamers et al., 2012), more research should be directed towards addressing how to improve SWB and which factors contribute to maintenance of SWB despite aging-related declines.

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Supplemental Material

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