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Perceived control and long-term changes in disability in late middle-aged and older persons: An eight-year follow-up study

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Abstract
This article examined the predictive role of perceived control in long-term changes in disability among 1541 independently living older persons. Disability referred to self-reported difficulties with (instrumental) activities of daily living. Perceived control referred to the extent to which one assumes oneself as having control over one's life chances, unlike the fatalistic assumption that one's life is ruled by external factors. Data on disability and perceived control were collected in 1993 and recollected in 2001. Covariates included age, gender, living arrangement, level of education, and the number of chronic medical conditions. Regression equations were estimated with disability in 2001 as outcome and the selected variables as predictors. The level of perceived control decreased and the level of disability increased significantly over an 8-year period. The predictive role of perceived control for subsequent change in disability was statistically significant but not very strong. The association between perceived control in 1993 and disability in 2001 was stronger for older persons (>65 years) compared to younger persons (≤65 years).

Keywords: *Perceived control, ageing, disability, mastery, prospective study, older people, Netherlands*

Introduction

The role of psychological attributes in older peoples' psychological and physical functioning has lately become a subject of interest in studies on ageing and on health-related

quality of life (e.g., Bienenfeld, Koenig, Larson & Sherrill, 1997; Bosma et al., 2004; Kempen et al., 1999a, 2003; Kramer, Kapteyn, Kuik & Deeg, 2002; Mendes de Leon et al., 1996; Ormel et al., 1997; Ranchor et al., 2002a; Roberts, Dunkle & Haug, 1994; Welch & West, 1995), specifically attributes related to a person's sense of control over his/her environment and his/her resources to deal with stressful changes in a particular situation. Perceived control (sometimes also indicated as *mastery*) concerns the extent to which one regards one's own life-changes as being under one's own control in contrast to being fatalistically ruled (Pearlin & Schooler, 1978). Personal (as well as social) resources are supposed to modify the negative effects of strains or stressors associated with an advancing age, such as: personal losses, loss of social roles and decline of health status (Kempen et al., 2003). This notion is derived from Folkman's and Lazarus' stress coping paradigm (Lazarus & Folkman, 1984). In that context, perceptions of control can be considered as personal resources for successful adaptation to lifetime challenges and can therefore be considered as part of the coping process (Femia, Zarit & Johansson, 1997; Rodin, 1987). Resources refer not to what people do, but to what is available to them in developing their coping repertoires (Pearlin & Schooler, 1978). Control beliefs may be derived from either previous experiences, from environmental factors or from other persons (Wallston, Wallston & DeVellis, 1978). Perceptions of control are dimensions of self-concept, tapping on what people are or think they are, whereas coping refers to what people do, i.e. what strategies they use under specific circumstances. Perceived control may affect the motivation for people to handle specific circumstances. In this study, we examine the role of perceived control in long-term changes in disability in a cohort of late middle-aged and older persons.

With respect to health changes, several studies emphasize the importance of individual differences in perceived control to health outcomes after confrontation with health-related stressors. Apparently, people who can rely on higher levels of control are also better adapted to coping with health problems, both emotionally and practically. This may lead to better preventive and compliance behaviour (Seeman & Seeman, 1983), protection against decline in physical functioning (Femia et al., 1997; Kempen et al., 1999a), quicker recovery of illnesses or injuries (Johnston et al., 1999; Kempen et al., 2000, 2003; Partridge & Johnston, 1989; Schwalbe & Gecas, 1988) and lower depression scores or higher levels of anxiety (Bienenfeld et al., 1997; Bosma et al., 2004; Turner & Wood, 1985).

Until now, the effect of perceived control on disability in older people has only been investigated cross-sectionally or in the short-term with a maximum of 4 years. Perceived control appeared to be a significant predictor for stability in mobility over a 4-year period in a study of Femia et al. (1997). Other studies on the subject suggested negative cross-sectional associations between perceived control and disability (Kempen et al., 1996a, b, 1999b). Furthermore, low levels of perceived control predicted functional decline over a 2-year period in low-functioning older adults (Kempen et al., 1999a) and prospectively in patients with acute myocardial infarction (Kempen et al., 2000) and stroke (Johnston et al., 1999). And finally, perceived control was related to recovery in patients with hip fractures (Furstenberg, 1988) or in patients with wrist fractures (Partridge & Johnston, 1989). In a recent prospective study, Kempen et al. (2003) reported rather small but significant effects of perceived control on recovery of physical function in an older sample of persons who experienced fall-related injuries. However, the impact of perceived control on long-term

changes in disability in independently living late middle-aged and older persons has not been studied.

In the present article, we examine the extent to which perceived control contributes to subsequent long-term changes in disability in a cohort of late middle-aged and older, independently living persons. Perceived control and disability were assessed in 1993 and were re-assessed in 2001. We hypothesized that – despite (changes in) medical problems and higher age and independent from other socio-demographics – persons with higher levels of perceived control would be able to preserve their level of functioning to a larger extent compared to persons with lower levels of perceived control. Perceived control may affect the motivation for people to handle specific circumstances in which health problems emerge.

Methods

Sample

The persons of this study participate in the Groningen Longitudinal Aging Study (GLAS). GLAS is a population-based prospective and longitudinal study on the determinants of health-related quality of life of older people who are living independently in the north of the Netherlands, either in the community or in sheltered accommodations. Eligible were all patients of 57 years and above from 27 general practices linked to a local morbidity registration network (99% of the non-institutionalized 57+ in the Netherlands are registered in general practices). In 1993, 5279 people completed baseline assessments (62% of the eligible population); 4792 were interviewed at home and completed self-report questionnaires, 487 answered a shorter version by telephone. Participants were asked to give informed consent to be approached for follow-up studies stemming from the baseline assessment. Objectives, design and matters of representativeness of the GLAS-baseline study were described elsewhere (Kempen et al., 1997a, b; Ormel et al., 1998). In short, the representativeness of the GLAS baseline sample has been studied in three ways (Kempen et al., 1997a). First, participant non-response was not random but associated with age: the participant rate among older persons was lower compared with the younger persons. Second, baseline participants ($n = 5279$) and non-responders were compared on four clusters of physician-registered morbidity: malignant neoplasms, ischemic heart diseases and congestive heart failure, chronic respiratory diseases, and chronic diseases of the locomotor apparatus. Multiple logistic regression analyses, including age and gender, showed no significant effects of the latter three on non-response. A significant ($p < 0.05$) effect was found for malignant neoplasms (higher proportion of patients among non-responders), but it was quite small. Third, only marginal differences were found in disability and chronic disease prevalences between the older persons in the Dutch General Health Surveys and the participants in the GLAS baseline study.

In 2001, eight years after the baseline assessment, 3216 persons were re-approached with a self-report questionnaire with a selection of baseline measures; 2063 persons were not re-approached in 2001 because the GLAS office was previously informed that baseline participants had died between 1993 and 2001 ($N = 783$) or were not willing to participate anymore in the study ($N = 1280$). From the 3216 baseline participants who was sent the questionnaire, another 180 had died between 1993

and 2001, 688 refused to return the questionnaire, and 216 were lost to follow up, making 2132 persons who returned the questionnaire to the GLAS office. From these 2132 persons, 299 did not complete all the measures, while another 292 persons only received the telephone baseline interview (see Methods) excluding several measures used in this article. This indicates that 1541 persons are included in the analyses of this article. The overall response rate at follow up was 32% (1541/4792).

Research model

Our basic research model is depicted in Figure 1. The main objective of the study refers to Arrow A. Because disability in 2001 may be influenced by disability in 1993, we included initial levels of disability as covariate (Arrow B). It is not clear whether the concept of perceived control can be considered as a trait or as a state (i.e. changeable) characteristic. Change in disability (i.e. disability in 2001 adjusted for disability in 1993) may therefore be influenced by (concurrent) change in perceived control. As a result, we adjusted for levels of perceived control in 2001 (Arrows C and F). In this way, we were able to identify the unique contribution of perceived control in 1993 to subsequent changes in disability. Furthermore, we included chronic medical morbidity (in 1993 as well as in 2001) and socio-demographics as covariates (Arrows D and E). The figure only displays the possible main effects of the selected predictors. We also studied whether the strength of the association between perceived control in 1993 and disability in 2001 (Arrow A) depends on the 1993 predictors. We therefore included first-order interaction terms between the perceived control in 1993 and these predictors in our regression models.

Measures

Disability was assessed with the Groningen Activity Restriction Scale (GARS). The GARS is a one-dimensional, hierarchical scale measuring grades of difficulties a
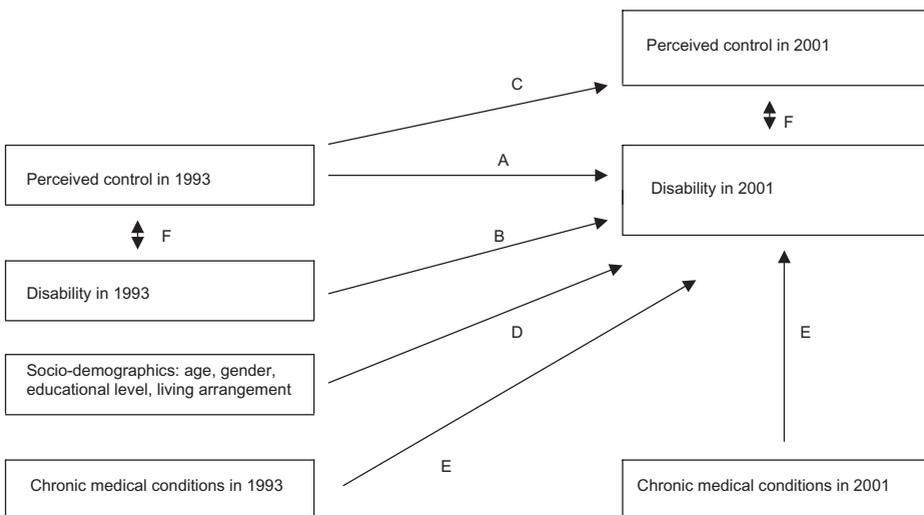

Figure 1.   Basic research model (see text).

person may experience when carrying out activities of daily living and instrumental activities. The scale comprises 18 items referring to activities in the domains of personal (activities of daily living – ADL) and domestic care (instrumental activities of daily living – IADL): "Can you, fully independently...dress yourself...get in and out of bed...stand up from sitting in a chair...wash your face and hands... wash and dry your whole body...get on and off the toilet...feed yourself...get around in the house (if necessary with a cane)...go up and down the stairs...walk outdoors (if necessary with a cane)...take care of your feet and toenails...prepare breakfast or lunch...prepare dinner...do 'light' household activities (for example dusting and tidying up)...do 'heavy' household activities (for example mopping, cleaning the windows and vacuuming)...wash and iron your clothes...make the beds...do the shopping". Each item has four answer options: (1) "Yes, I can do it fully independently without any difficulty", (2) "Yes, I can do it fully independently but with some difficulty", (3) "Yes, I can do it fully independently but with great difficulty", and (4) "No, I cannot do it independently, I can only do it with someone's help" (theoretical range 18–72). The GARS was earlier used in several studies in the Netherlands and in a multicenter longitudinal European study on incapacitating diseases, 'EURIDISS' (Suurmeijer et al., 1994). The GARS meets the stochastic cumulative scalability criteria of the Mokken model (Kempen & Suurmeijer, 1990; Kempen et al., 1996c) and has proven its effectiveness for measuring levels of disability in international, comparative and longitudinal studies, both across countries and across diseases. Earlier research showed strong associations between the GARS and the physical functioning subscale of the SF-20 ($r = -0.72$) and the OECD indicator freedom of movement (0.74) (Kempen et al., 1996c). Furthermore, the GARS was strongly associated with the physical mobility subscale of the NHP (0.78) and the Karnofsky physical status scale (0.68) (Suurmeijer et al., 1994). Disability was measured at baseline in 1993 and at follow up in 2001. The internal reliability estimate was 0.91 at baseline.

Perceived control was measured at baseline and follow-up with the 7-item mastery scale (theoretical range 7–35), developed by Pearlin and Schooler (1978). The 7 items are: "I have little control over the things that happen to me", "There is really no way I can solve some of the problems I have", "There is little I can do to change many of the important problems I have", "I often feel helpless in dealing with the problems of life", "Sometimes I feel that I'm being pushed around in life", "What happens to me in the future mostly depends on me", and "I can do just about anything I really set my mind to do"; each item has five-answer options ranging from 'strongly agree' to 'strongly disagree'. The psychometric properties of the Dutch version of this scale was successfully tested in an earlier pilot study (e.g., internal reliability estimate of 0.71, 8-week test-retest reliability of 0.67 and no significant difference in mean score over the 8-week period (Kempen, 1992)). The internal reliability estimate for perceived control in the present study at baseline was 0.79.

Educational level, health status, living arrangement, gender, age and physical functioning were found to be interrelated (e.g. Kempen et al., 1999c). Furthermore, health status and age were related to perceived control in older males and older females (Kempen et al., 1997a). These variables were included as covariates in the models in the present article. As an indicator of health status, we used chronic medical morbidity as assessed at baseline. A checklist was administered, comprising 19 chronic

medical conditions: asthma or chronic bronchitis, pulmonary emphysema, heart condition, hypertension (consequences of), stroke, leg ulcer, stomach ulcer, liver disorder or gallstones, kidney disease, diabetes mellitus, thyroid gland disorder, back problems for at least 3 months or slipped disc, joint conditions or arthritis, migraine or chronic headache, serious dermatological disorders like psoriasis and eczema, cancer, multiple sclerosis, and Parkinson's disease or epilepsy. The participants were asked whether they suffered from one or more of these conditions during the 12 months prior to the interview. This procedure was similar to the procedures used by the Netherlands Central Office of Statistics (CBS) in periodic health surveys. In order to reduce any report-bias, only those conditions that required a GP or specialist consult and/or prescription of medicine were counted. The number of medical conditions was used as an index. The level of education was selected as an indicator for socioeconomic status. We assessed the level of education according to the International Standard Classification of Education (ISCED (Unesco, 1976)). The index distinguishes six levels of education: no (elementary) school, elementary school, vocational training, high-school, undergraduate degree and graduate degree. The level of education is based on both standard formal education and vocational courses during adult life. Additionally, age, living arrangement (living alone *vs* not living alone) and gender were included as covariates.

Analytic strategy

Descriptive statistics were computed for all the variables and paired *t*-tests were used to test for differences between the 1993 and the 2001 scores. Next, effect sizes for change in disability and perceived control were computed. The effect size (ES) for independent means can be computed as: difference in mean between 1993 and 2001 divided by the joint standard deviation (Cohen, 1992). For paired data, this ES coefficient should be corrected for the interrelation between both the observations. The ES for paired observations $= [(\text{ES for independent observations})/(\text{square root} (1-r))]$ (Garssen & Hornsveld, 1992). An ES of 0.20 can be considered as small, an ES of 0.50 as medium, and an ES of 0.80 as large (Cohen, 1992). Furthermore, Spearman's (bivariate) correlation coefficients were calculated for all variables. Then, a series of hierarchical linear regression analyses were conducted to examine the (prospective) contribution of perceived control in 1993 to disability in 2001, controlling for the selected covariates, i.e. age, gender, living arrangement, level of education, initial levels of disability, and the number of chronic medical conditions in 1993 and 2001. Variables were entered in the following order: perceived control in 1993 to identify the gross effect of perceived control (step 1), age, gender, living arrangement, level of education, chronic medical conditions in 1993 and 2001, and disability in 1993 to adjust for these initial covariates (step 2), and perceived control in 2001 (step 3). The latter one was added in the final step to adjust for concurrent changes in perceived control. In separate analyses, we added each of the first-order interaction terms between perceived control in 1993 and the predictors (step 4). Standardized regression coefficients were computed. Before the regression analyses were conducted, the outcome variable (GARS in 2001) was transformed logarithmically; as a result the skewness coefficient was reduced from 1.9 to 1.2, which was considered as acceptable. Results were considered significant if $p < 0.05$. Data were analyzed using the SPSS/PC software, version 10.

Preliminary analysis

As mentioned, 1541 persons were included in the analyses of the present article. The non-participants at follow-up reported higher levels of disability at baseline (mean score of 24.2 *vs* 20.6, $p < 0.05$), lower levels of perceived control (24.3 *vs* 25.7, $p < 0.05$), higher number of chronic medical conditions (1.2 *vs* 1.0, $p < 0.05$), and lower levels of education (3.0 *vs* 3.4, $p < 0.05$) compared to the participants at follow-up. Furthermore, the non-participants were older (70.8 *vs* 66.5 years at baseline, $p < 0.05$) and included more females (57% *vs* 54%, non-significant).

Results

Table I presents the descriptive statistics of the study sample. The mean age at baseline was 66.5 years and ranged from 57 to 88 years. Most of the participants were women (54.3%; $N = 836$). The level of disability significantly increased between 1993 and 2001 ($t = -21.1$, $df = 1540$, $p < 0.01$). The level of perceived control significantly decreased between 1993 and 2001 ($t = 23.2$, $df = 1540$, $p < 0.01$).

The effect size (corrected for paired observations) for disability was 0.84. The effect size for perceived control was 0.85.

The Spearman correlation coefficients between the selected variables are presented in Table II. The correlation between perceived control in 1993 and 2001 was 0.49.

Table I. Descriptive statistics of study sample at baseline in 1993 and at follow-up in 2001 ($n = 1541$).

	Mean	SD	Observed range
Age (years)			
At baseline in 1993	66.5	6.4	57–88
Gender			
Women (%)	54.3		
Men (%)	45.7		
Living arrangement			
Living alone (%)	22.5		
Living not alone (%)	77.5		
Education			
Score according to UNESCO[a]	3.4	1.1	1–6
No (elementary) school (%)	1.0		
Elementary school (%)	23.7		
Vocational training (%)	28.4		
High-school (%)	32.9		
Undergraduate degree (%)	11.6		
Graduate degree (%)	2.5		
Chronic medical conditions[b]			
At baseline in 1993	1.0	1.1	0–10
At follow-up in 2001	1.3	1.4	0–9
Disability[b]			
At baseline in 1993	20.6	5.2	18–66
At follow-up in 2001	25.1	9.9	18–72
Perceived control[a]			
At baseline in 1993	25.7	4.9	11–35
At follow-up in 2001	22.9	4.4	7–35

Note: All differences between 1993 and 2001 are statistically significant, $p < 0.05$.
[a]Higher scores indicate higher levels of education and perceived control.
[b]Higher scores indicate poorer function.

Table II.   Spearman correlation coefficients of variables in the study ($n = 1541$).

	1	2	3	4	5	6	7	8	9
1. Disability in 1993[a]									
2. Disability in 2001[a]	0.54★								
3. Perceived control in 1993[b]	−0.25★	−0.31★							
4. Perceived control in 2001[b]	−0.18★	−0.33★	0.49★						
5. Number of chronic conditions in 1993[a]	0.36★	0.31★	−0.16★	−0.15★					
6. Number of chronic conditions in 2001[a]	0.24★	0.34★	−0.09★	−0.13★	0.41★				
7. Age	0.24★	0.41★	−0.12★	−0.20★	0.09★	0.06★			
8. Gender[c]	0.07★	0.13★	−0.16★	−0.12★	0.12★	0.00	0.06★		
9. Educational level[d]	−0.09★	−0.16★	0.17★	0.14★	−0.07★	−0.01	−0.16★	−0.28★	
10. Living arrangements[e]	−0.10★	−0.18★	0.10★	0.05	−0.05	−0.01	−0.23★	−0.31★	0.08★

★$p < 0.05$.
[a]Higher scores indicate poorer function.
[b]Higher scores indicate higher levels of perceived control.
[c]1 = male, 2 = female.
[d]Higher scores indicate higher levels of education.
[e]1 = living alone, 2 = not living alone.

Furthermore, perceived control in 1993 was significantly related to all other selected variables although the strength of association was not always strong (range of correlations: 0.09–0.31). Persons with higher levels of perceived control in 1993 reported less disability and a lower number of chronic medical conditions in 1993 and in 2001. Furthermore, higher levels of perceived control were related with younger age and higher education. Females and those living alone reported less perceived control compared to males and persons not living alone. Disability in 1993 was strongly related to disability in 2001 (0.54). Lower levels of perceived control in either 1993 or 2001 was related to more disability in 2001. Persons with more chronic medical conditions, higher age and lower education reported more disability in 2001. And finally, females and those living alone reported more disability compared to males and persons not living alone.

Table III comprises the outcomes of the multiple regression analyses. Perceived control in 1993 was a significant predictor of disability in 2001 (standardized $\beta = -0.31$, step 1), even if the effects of all covariates including perceived control in 2001 were controlled for in step 3 (β then decreases to -0.09, $p < 0.05$). The total amount of variance explained in step 1 was 0.10, in step 2 0.47 and in step 3 0.48. The results of steps 1–3 indicate that lower levels of perceived control in 1993 predicted higher levels of disability in 2001, although the impact was not very strong. Step 4 consisted of the analysis of the first-order interaction effects. The results indicated that the effects of perceived control in 1993 on disability in 2001 did not significantly differ between persons with high and low levels of disability or chronic morbidity in 1993, between men and women, between participants with higher and lower levels of education, and between those living alone versus those not living alone, respectively. However, the multiple regression model including the first-order interaction term of perceived control in 1993 and age yielded a significant β-coefficient for this term (R^2 change after inclusion of this interaction term was 0.4%, F-change was 13.3, $p < 0.001$; none of the significant main effects of step 3 became

Table III.   Summaries of multiple hierarchical regression models, testing the effect of perceived control in 1993 and covariates and first-order interaction effects on disability in 2001 ($n = 1541$).

	Disability in 2001[a]											
	Step 1			Step 2			Step 3			Step 4		
	β	SE β	p	β	SE β	p	β	SE β	p	β	SE β	p
Perceived control in 1993[b]	−0.31	0.02	0.00	−0.15	0.02	0.00	−0.09	0.02	0.00			
Disability in 1993[a]				0.37	0.02	0.00	0.38	0.02	0.00			
Number of chronic conditions in 1993[a]				0.04	0.02	0.06	0.04	0.02	0.07			
Number of chronic conditions in 2001[a]				0.23	0.02	0.00	0.22	0.02	0.00			
Age				0.30	0.02	0.00	0.28	0.02	0.00			
Gender[c]				0.03	0.02	0.13	0.03	0.02	0.22			
Educational level[b]				−0.02	0.02	0.31	−0.02	0.02	0.41			
Living arrangement[d]				−0.03	0.02	0.14	−0.04	0.02	0.06			
Perceived control in 2001[b]							−0.14	0.02	0.00			
Disability in 1993 × perceived control in 1993										−0.12	0.11	0.25
Number of chronic conditions in 1993 × perceived control in 1993										−0.08	0.10	0.39
Age × perceived control in 1993										−0.77	0.21	0.00
Gender × perceived control in 1993										−0.01	0.11	0.91
Educational level × perceived control in 1993										0.06	0.13	0.62
Living arrangement × perceived control in 1993										0.04	0.13	0.74

Note: Standardized regression coefficients are presented. Step 1 $R^2 = 0.10$ ($F(1, 1539) = 162.0$, $p < 0.001$); Step 2 R^2-change $= 0.38$ (F-change$(7, 1532) = 154.7$, $p < 0.001$); Step 3 R^2-change $= 0.01$ (F-change $(1, 1531) = 40.0$, $p < 0.001$); Step 4 consists of inclusion of individual interaction terms after step 3.
[a]Higher scores indicate poorer function.
[b]Higher scores indicate higher levels of perceived control and education.
[c]1 = male, 2 = female.
[d]1 = living alone, 2 = not living alone.

non-significant). The median score for age (65 years) was used to create subgroups and to compute β-coefficients for perceived control in 1993 on disability in 2001 in the subgroups. The impact of perceived control in 1993 on disability in 2001 was stronger for older participants (standardized β-coefficients of −0.11) compared to the younger participants (standardized β-coefficients of −0.06). The variance inflation factor (VIF) was used to measure collinearity in all regression models. The highest VIF (excluding those in the models with the first-order interaction terms) was 1.40 and therefore much lower than 10.0 which can be considered as acceptable (Kleinbaum et al., 1988).

Discussion

The objective of this study was to examine perceived control as a predictor of long-term changes in disability (self-reported ADL/IADL disability) of independently living late middle-aged and older people. Perceived control was considered a personal resource, playing a direct or indirect role in the coping process of people who were confronted with health problems. We presumed that older persons who could rely on high levels of control would keep their levels of functioning more in the long run, than persons with low levels of control, irrespective of individual differences as to the previous levels of functioning, chronic medical morbidity, gender, living arrangement, age, and level of education. Perceived control and disability were assessed in 1993 and re-assessed in 2001. Perceived control, as assessed in 1993, was significantly related to disability in 2001, controlled for the selected covariates (including the concurrent changes in perceived control in the period of study). Our hypothesis was therefore confirmed. We may conclude that perceived control as assessed in 1993 influences disability later on (irrespective of changes in perceived control), although the impact was not very strong: standardized β-coefficient of -0.09. The association between perceived control in 1993 and disability in 2001 was stronger for older persons compared to younger persons. Furthermore, age and the number of chronic medical conditions were significantly associated with disability in 2001. And finally, we may conclude that the level of perceived control changed substantially over an 8-year period among these independently living older people. The mean score of the perceived control scale decreased significantly from 25.7 to 22.9, while the correlation coefficient between the 1993 and 2001 scores was 0.49 ($p < 0.05$). The effect size was 0.85 which can be considered as large (Cohen, 1992). One can argue about whether perceived control can be considered as a trait or a state characteristic. We found a substantial change in perceived control over a period of eight years in these late middle-aged and older persons. This supports evidence of a state like quality to perceived control.

Initial levels of disability, chronic morbidity (in 2001) and age are significant independent predictors of disability later on. This is consistent with previous research. The impact of perceived control on functioning in older persons was up until now only studied cross-sectionally or in the shorter term (Femia et al., 1997; Johnston et al., 1999; Kempen et al., 1996a, 1999a). Our results showed that these results can be generalized to longer periods of time although the impact of perceived control on disability is not very strong.

Some comments have to be made regarding these results. Due to various reasons, we only included 1541 persons in our study while the source population of the Groningen Longitudinal Aging Study consisted of 5279 persons. Non-participants reported higher levels of disability in 1993, lower levels of perceived control, more chronic medical conditions, and lower levels of education compared to the participants (see Methods). Furthermore, the non-participants were older compared to the participants. Although substantial attrition is common in studies among older persons, this may have affected our outcomes. The attrition of more disabled and vulnerable persons may have weakened (and therefore underestimated) the identified associations in our sample. However, particularly *descriptive* outcomes in ageing studies may be strongly affected by attrition, but attrition not always seems to be a serious problem when *associations* between variables are the focus of study as is the case

in the present article (Crawford et al., 1995; Kempen & Van Sonderen, 2002). A strong and unique point of the present study is its eight-year longitudinal, prospective character and the re-assessment of perceived control and disability.

The question remains, how to evaluate the results of this study (i.e. a significant but not very strong impact of perceived control on long-term changes of disability) in the light of other studies that proposed an independent contribution of perceived control over either disability or decline of functioning in older populations? One important difference between the studies in this area is that some studies specifically dealt with an abrupt and, usually, sharp decline of physical capacities (hip fracture, fall related injuries, stroke, acute myocardial infarction (Furstenberg, 1988; Johnston et al., 1999; Kempen et al., 2000, 2003; Partridge & Johnston, 1989) while other studies were focused on a gradual decline in functioning (Femia et al., 1997; Kempen et al., 1999a; Mendes de Leon et al., 1996). Regaining capacities in the former type of studies will largely be dependent on medical interventions and physical reserves, whereas personal efforts may only add to a lower extent to the rehabilitation process. The second type of studies (gradual decline) seems to show some stronger positive effects from perceived control over disability in older people. Feeling more secure about one's capacities to perform everyday life activities may well stimulate older people to stay active, which in itself may be beneficial for delaying the negative consequences of physical decline. As a result, the interventions to be developed may differ – distinguishing between, primary prevention type efforts to 'resist or fight off' decline, and secondary interventions 'to reduce effects of, or recover from, decline'. Furthermore, most of the mentioned studies used generic measures of perceived control and not domain-specific constructs to indicate perceived control (such as health locus of control). None of the studies examining the effect of perceived control on physical functioning, including our own, could explain more than a small proportion of observed differences in physical functioning. The relatively low contribution of perceived control may be due to the fact that we also used (general) perceived control as a personal attribute. Ranchor et al. (2002b) reported a correlation of only 0.20 between (domain-specific) health locus of control and (general) perceived control in cancer patients indicating that both concepts are not measuring the same.

One can argue about the fact that the way we operationalized disability ('Can you fully independently...') incorporates a large degree of perceived control indicating confounding. However, the GARS refers to very specific activities, while the Pearlin & Schooler measure is much more general. Furthermore, both the concepts have their own very long tradition in scientific research and literature. And, finally, if both concepts really measured more or less the same, their concurrent interrelationship should be much stronger than -0.25 (in 1993) or -0.33 (in 2001).

We did not include the assessment of coping in our study. Direct effects of perceived control on disability as well as mediating effects of coping between perceived control and disability can be considered. Some studies have actually found the effects to be direct, not mediated by coping (e.g. Johnston et al., 1999). Further research is needed to explore the direct or indirect effects of perceived control on functional decline in older persons.

Apparently, in older people, perceived control as a personal resource plays only a minor role in disablement processes, whether this regards a sudden loss of functions caused by an accident or the negative consequences of natural physical decline. To a certain extent, (self-management) intervention programs, aimed at enhancing

situational feelings of control, may encourage older persons to do the prescribed exercises, or to resume activities of everyday life that they no longer feel confident with. We identified stronger effects of perceived control on disability in older persons at higher age compared to middle-aged older persons, so interventions may particularly be tailored to the first subgroup. Further, research should determine whether a much direct benefit can be expected from such interventions to increase functioning and ability, since, till date, intervention studies have been scarce and have only produced suggestions for possible success (Allegrante et al., 1991; Johnston et al., 1992). Exception are the studies of Tennstedt and colleagues (Tennstedt et al., 1998) who evaluated a successful intervention to reduce the fear of falling and to improve the physical and social function in older persons, and Lorig and colleagues (Lorig et al., 1999, 2001), who showed that a chronic disease self-management program improved levels of self-confidence and functioning in patients with chronic diseases.

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