

Adaptive strategies after health decline in later life: increasing the person-environment fit by adjusting the social and physical environment

Fleur Thomése · Marjolein Broese van Groenou

Published online: 7 November 2006
© Springer-Verlag 2006

Abstract Following the press-competence model (PCM) of Lawton and associates, we tested two expectations as to the adaptations older adults make to their socio-physical environment following health decline: (1) depending on the change in their functional limitations, older adults use adaptive strategies ranging from mobilizing informal care to moving into a residential setting; (2) the more people succeed in realizing suitable adaptations, the higher their wellbeing, measured as depressive symptoms, after a health decline. Data come from two waves of a longitudinal study among Dutch people aged 60–85 and living independently at baseline (Longitudinal Aging Study Amsterdam, LASA). The 819 respondents with a decline in self-reported functional disability within 3 years time were selected for analysis. Results of multivariate logistic and regression analyses show that (1) all adaptive strategies under study occur in response to health decline; (2) mobilization of informal care and moving to a care setting alleviates the negative effect of health decline on depressive symptoms. Furthermore, mobilization of professional home care was associated with more depressive symptoms independent of health decline, whereas adjustment of the home had no effect on depressive symptoms. We argue that some support was found for Lawton's PCM, but that evidence can be improved by studying more closely which adaptive strategies alleviate the environmental stress induced by specific physical disabilities.

Keywords Person-environment fit · Functional decline · Informal care · Professional care · Lawton

Introduction

Although the importance of the physical and social environment for aging well is widely recognized in social gerontological theorizing (Wahl and Lang 2004), little is known of the way people adapt their environment after functional loss resulting from health decline in later life. Health decline and functional loss can have a strong negative impact on wellbeing in later life, and may even lead to depressive symptoms (Beekman et al. 1995). It is important, therefore, to gain more insight into adaptive strategies that may help reduce the negative impact of decreasing health through functional loss. Previous research typically addresses environmental factors as conditions or resources, rather than as instruments that older adults may actively use for adapting to functional changes. Thus, there is a wide body of research on the impact of environmental factors on health (Balfour and Kaplan 2002; George 1996; Schwarzer and Leppin 1991), but hardly any on the consequences of health decline or functional loss for dealing with the environment. In the research we did find, health only serves as a control in assessing changes people make to the environment (Lang 2000), or the focus is limited to either changes in social networks (e.g., van Tilburg and Broese van Groenou 2002) or changes in the physical environment (e.g., Iwarsson 2005; Speare et al. 1991). Links between the social and the physical environment are rarely made (Wahl and Lang 2004). Research in this field is typically limited to small, selective samples or

F. Thomése (✉) · M. Broese van Groenou
Department of Social Cultural Sciences, Vrije Universiteit,
De Boelelaan 1081c, 1081 HV Amsterdam, The Netherlands
e-mail: gcf.thomese@fsw.vu.nl

cross-sectional data (Knipscheer et al. 2000; Wahl and Lang 2004).

In this paper, we adopt a broader view on adaptive strategies after functional loss that involves both the social and the physical environment. Given that many people experience such a decline at some point in later life, we want to examine how they use their physical and social environment to adapt to the changes in health. In doing so, we also want to test central theoretical notions about environmental adaptations to health change, as put forward by Lawton and associates (Lawton and Nahemov 1973; Lawton 1982a). Research questions to be answered are: (1) To what extent do adults make adjustments to their social and/or physical environment and how are these adjustments related to functional loss resulting from health decline? (2) To what extent do adjustments to the social and/or physical environment contribute to (restored) wellbeing after functional loss resulting from health decline?

Theoretical model

One of the main theoretical models on the interactions between older persons and their environment is the press-competence model (PCM) introduced by Lawton and Nahemov (Lawton and Nahemov 1973; Lawton 1982a; Wahl and Lang 2004). The focus of the original model is on the fit between capacities of the person, or competencies, and the more or less demanding characteristics of the environment, or environmental press. Competencies include individual characteristics such as subjective and objective health, and various abilities that are innate or can be learned. The environment includes both the physical (e.g., housing, physical aids) and the social (e.g., formal and informal help, opportunities for social activities) context. The PCM has undergone several adaptations over time, but two main theoretical statements remained: (1) optimal behaviour can occur when there is a fit between competencies and environmental press, and (2) person-environment fit therefore leads to greater wellbeing. Optimal behaviour can be either objective, as in maintaining one's life style or keeping a certain level of mobility, or subjective, which is an individual's perception of his or her efficacy. If there is a misfit between person and environment, adaptations in competencies and/or the environment need to be made. Otherwise, non-optimal behaviour will lead to lowered levels of wellbeing.

Following the PCM, responses to functional loss in later life can be divided into two categories: increasing the capacity to deal with demands from the environment or decreasing such demands. The first category,

increasing one's competencies, most notably includes efforts to decrease the functional limitations. Although this strategy can also be applied in later life, e.g., by training or using walking aids, we will focus on the environmental adjustments, the second category. Decreasing environmental press may include a wide range of social and physical adaptations that involve either reduction of demands from the environment or increased usage of resources from that environment. The environment may contain several physical and social strata (Lawton 1982a), but for the purpose of this study we confine ourselves to a general division between the physical environment, involving material and physical conditions (most notably, housing conditions), and the social environment, involving relationships and other persons in the environment (most notably, care arrangements; Wahl and Lang 2004).

The PCM does not give substantive predictions under which conditions individuals will choose certain adaptations. But we can formulate some general expectations. The general model implies that people will select adaptations that facilitate continuation of their previous behaviour, i.e., adaptations that require a minimum of change and that best compensate for the functional loss. Regarding research question 1, we expect that the severity of the health decline partly determines the severity of the adaptation, and that minor adaptations are preferred over more invasive ones. We consider relatively isolated changes in the social or physical environment, such as (a) mobilizing informal care and (b) making small adjustments in the house, less invasive than those that involve more areas of life, such as (c) mobilizing professional home care or (d) moving to a care setting, varying from adapted housing to residential care.

According to the PCM, the more people succeed in realizing suitable adaptations that fit their health needs, the higher their wellbeing after the functional change. In this study, we will evaluate the person-environment fit after functional loss by examining depressive mood as an indicator of general wellbeing (Knipscheer et al. 2000; Lawton 1980). Other studies have shown that depressed mood is associated with both functional loss (Braam et al. 2005) and use of care (Pot et al. 2005), implying that any interaction between these two factors should be reflected in a change in depressed mood. Regarding research question 2, we expect that the impact of functional loss on depressive symptoms is moderated by the use of an appropriate strategy. For example, mobilization of informal care is appropriate when functional loss is experienced, but may be negatively experienced when no need for such care has arisen.

Method

Respondents

The data for this study are derived from the Longitudinal Aging Study Amsterdam (LASA). The LASA interviews covered a wide range of topics related to physical and cognitive health, and social and psychological functioning. The sample is based on a nationally representative cohort, initial ages 55–85 years, with oversampling of men and older-old. The sample was recruited for the Netherlands Stimulating Programme on Research on Aging (NESTOR) study on Living Arrangements and Social Networks of older adults (LSN), which had a response rate of 62.3% ($n = 3,805$) (Knipscheer et al. 1995). About 10 months after the LSN interview, the participants were approached for the first LASA cycle (T_1 , 1992–1993) (Deeg et al. 1993). By the start of the LASA baseline, there were 3,679 surviving LSN participants. Of these survivors, 3,107 subjects took part in the interviews and tests, yielding a response rate of 85%; the 15% non-response consisted of 4% ineligibility through frailty, 1% not contacted after eight or more attempts, and 11% refusals. Non-response was associated with higher age and lower education (Deeg et al. 2002). In 1995–1996 (T_2), a follow-up was carried out. Of the surviving 2,689 participants, 95% (2,545) were included in the follow-up; 1% was ineligible, <1% was not contacted, and 3% refused.

We base our study on respondents from these 2,689 who were 60 years or older at T_1 (leaving $N = 2,119$). Respondents institutionalized at T_1 ($n = 62$) were excluded, as moving to a care setting was one of the outcome variables. From the remaining 2,059 respondents, 959 men and 1,098 women, we selected the persons who experienced a decrease in self-reported functional limitations between T_1 and T_2 or who had functional limitations at T_1 that had not improved at T_2 . This left a sample of 819 respondents. Our selection criterion is described in [Measurements](#).

The study sample consisted of 60% women and 56% respondents living with a partner at T_1 . The mean age at T_1 was 74.7 years ($SD = 6.9$).

Measurements

The wellbeing was measured with scores on the Center for Epidemiologic Studies Depression Scale (CES-D), a 20-item scale measuring *depressive symptoms* (Radloff 1977) which has been widely used in older populations (Beekman et al. 1995). Scores range from 0 to 60, Cronbach's $\alpha = 0.87$. A score of 16 or higher is

considered to be clinically relevant (Beekman et al. 1995). The mean score at T_1 was 9.3 ($SD = 8.4$), at T_2 it was 10.2 ($SD = 9.3$).

Functional loss following health decline is indicated by changes in the degree of self-reported functional disability. This operationalization enables us to identify those respondents whose health decline had an impact on their competence. Six items measuring the capacity to perform activities in daily life assess functional disability, e.g., “can you walk up and down stairs?” The five possible answers were: not at all, only with help, with a great deal of difficulty, with some difficulty, and without difficulty. The six items constituted hierarchically homogeneous scales at the observations (Loevinger's $H \geq 0.59$), which were reliably measured ($\rho \geq 0.83$). The scales ranged from 0 (no disability) to 24 (severe disability). We calculated the reliable change index (RCI) for disability change between T_1 and T_2 . The RCI is a commonly used measure to determine the extent to which variations over time reflect real changes, taking into account the mean, standard deviation and reliability of the scaled items (Jacobson and Truax 1991; Speer 1999). Of the 819 respondents selected, 392 experienced a disability increase ($RCI > 0$, $P < 0.10$) between observations, which corresponds with an increase in ADL score of 4 or more points. A total of 427 respondents retained a disability score below 24 ($RCI = 0$). The disability increase scale ranged from 0 (no change or change of < 4 points) to 20. At T_1 , respondents had an average disability score of 4.2 ($SD = 4.3$), at T_2 this was 6.9 ($SD = 5.4$). The average increase was 2.7 scale points ($SD = 4.0$).

Adaptations in the socio-physical environment were changes in the use of informal care and professional home care, an increase in the number of adjustments in the house, and moves to a care setting. Respondents, who reported difficulty with the performance of personal care activities and/or domestic tasks, were asked if they received any help, and who helped them. Answers were scored as the use of *informal care* (0 = no help, 1 = help from partner, children, neighbours, and/or friends) or the use of *professional home care* (0 = no help, 1 = help from public home care, district nurse, and/or personnel from residential home). Change scores indicated: 0 = no change in (in)formal care use between T_1 and T_2 , or a loss of care at T_2 , 1 = no use of (in)formal care at T_1 , but use reported at T_2 . At T_1 , 536 respondents (65.4%) received no informal care, and 668 (84.0%) received no professional care.

Respondents were asked to indicate whether there were *adjustments* in the house, i.e., an adapted telephone or an alarm, adaptations to the stairs and

adaptations to the kitchen, bathroom or bedroom. Up to 17 adjustments could be reported. Reporting an increase of three or more adjustments is counted as a significant change in the number of adjustments between measurements (0 = less than 3 adjustments, 1 = 3+ adjustments). The average number of adjustments at T_1 was 0.76 (SD = 1.56), with 717 respondents (87.5%) having two or less adjustments in the house.

Using the respondent's address, it was assessed whether a respondent had moved between waves. At each observation, the interviewer observed the type of housing. We analysed moves to housing adapted for older adults (e.g., apartment building with services, housing near an institution including services provided by the institution), and moves to an institution (a residential or nursing home). Because of low frequencies ($n = 53$ and 63 , respectively) both types of moves were collapsed into one variable indicating a move to a care setting. Moves to regular housing ($n = 38$) were not distinguished.

To control for confounding effects on the environmental adaptations, gender, age, educational level and level of urbanization were used, as well as the partner status at T_1 and changes in partner status. *Educational level* was measured in years (range = 6–18 years, mean = 8.5 years, SD = 3.4 years). The level of *urbanization* was used to control for unmeasured differences in the availability of (in)formal care (Van der Meer 2006; Boerma et al. 1998). The level of urbanization at T_1 was measured in five ordinal classes, ranging from (1) not urban (less than 500 addresses per squared kilometre) to (5) very highly urban (more than 2,500 addresses). The average level of urbanization was 3.0 (SD = 1.5).

Statistical analyses

Analyses were performed separately for non-movers ($N = 703$) and movers to a care setting ($N = 161$). For the non-movers, the percentages of respondents mobilizing (in)formal and/or experiencing three or more adjustments in the house were reported. Combinations of adjustments are counted for the non-movers as well as the movers to indicate to what extent multiple adaptive strategies are used by the sample.

Effects of the change in functional disability on four types of socio-physical environmental adaptations (mobilization of informal or professional home care, 3+ adjustments, moving to a care setting) were assessed through logistic regression analyses for each of the adaptations. Explanatory variables were time, the control variables and baseline measures of care used, and number of home adjustments. The odds ratios (OR) of

the baseline functional disability and the decline score indicated to what degree the adaptive strategies were associated with health and health decline.

To assess whether the socio-physical environmental adaptations modified effects of functional disability change on depressive symptoms at T_2 , we tested four models in linear regression analyses, each testing effects of one adaptation. All models included control variables, baseline measures, and disability increase scores. Each model further contained an interaction term, of the disability change patterns and the adaptation under analysis.

Results

The use of adaptive strategies

Of the non-movers ($N = 703$), small percentages mobilized informal care (13%), formal care (11%), and adjustments in the home (11%). Combinations of adaptations occurred in only 32 cases and involved all combinations between the three adaptive strategies. Thus, persons with functional loss who remained living independently used mostly single adaptive strategies, but for the majority no changes were made in the use of (in)formal care or the number of home adjustments. Of the 116 respondents who moved into a care setting, 13% reported the mobilization of informal care, 43% the mobilization of formal care, and 85% reported adjustments in the house. About half (45%) reported both home adjustments and the mobilization of formal care, suggesting that this type of move involves both social and physical adjustments.

Functional loss and adaptive strategies

Table 1 shows the results of logistic regression analyses of the socio-physical environmental adaptations. All adaptations are affected at a comparable level by changes in disability between T_1 and T_2 , with an increase in disability resulting in a higher likelihood of adapting. The effect is weakest for the mobilization of informal care (OR = 1.08, $P < 0.10$), indicating that informal care is mobilized in a wide range of disability situations. The use of informal and professional care is not affected by baseline disability. Adjustments in the home and moving are affected by T_1 disability, with higher scores increasing the probability of these adaptations.

The move into a care setting is furthermore contingent upon the presence of a spouse. In particular when the spouse is lost between T_1 and T_2 , there is an

Table 1 Logistic regression analyses of disability and disability changes on adaptations at T_2

	Living independently T_1-T_2 ($N = 703$)						Moved to a care setting ($N = 116$)	
	Mobilization of informal care		Mobilization of professional care		More adjustments in the home		OR	<i>P</i>
	OR	<i>P</i>	OR	<i>P</i>	OR	<i>P</i>		
<i>T</i> ₁ controls								
Sex (m, f)	1.24		1.43		0.77		0.80	
Age (years)	1.02		1.03		1.01		1.08	***
Partner (no, yes)	1.52		0.61		1.41		0.59	~
Education (years)	0.98		1.00		1.02		0.98	
Urbanization (1–5)	0.79	***	1.05		0.83	*	0.90	
Informal care (0,1)	–		1.31		1.01		1.52	~
Professional care (0,1)	0.61		–		2.54	**	1.23	
Adjustments (0–17)	0.99		0.89		0.79	*	0.93	
Disability (0–18)	1.01		1.05		1.15	***	1.09	***
Time-dependent variables								
Lag T_1-T_2 (2.3–4.1)	1.14		0.78		1.93		9.48	***
Partner lost (0,1)	0.43		1.91		1.76		2.78	**
Increase in disability (0–19)	1.08	~	1.18	***	1.14	***	1.10	**

~*P* < 0.10; **P* < 0.05; ***P* < 0.01; ****P* < 0.001

increase in the probability of moving (OR = 2.78). Use of professional home care at T_1 and a lower number of adjustments at baseline increase the likelihood of having more adjustments in the home at T_2 . Again, the social adaptation of mobilizing care appears to be realized earlier than physical adjustments in the house. Urbanization has a negative effect on mobilization of informal care and increasing adjustments in the house.

Changes in depressive mood

Disability at baseline does not contribute to depressive mood at T_2 , but the increase in disability leads to more depressive symptoms at T_2 (Table 2, β is between 0.15 and 0.19). Changes in the use of informal care contributed positively in interaction with disability changes to depressive symptoms at T_2 ($\beta = 0.09$). This points out that among those experiencing no significant change in disability, mobilizing informal care slightly increases depressive symptoms, whereas the mobilization of informal care reduces depressive symptoms among those with increased disability at T_2 (Fig. 1).

Mobilization of professional care contributed directly to depressive symptoms at T_2 and not in interaction with the presence and/or increase of disability (Table 2). There is a weak interactive effect of an increased number of adjustments in the home on depressive symptoms ($\beta = 0.07$). It appears that those experiencing an increase in disability who obtained extra adjustments in the house had more depressive symptoms than when increased disability was not accompanied by home adjustments (Fig. 2).

A positive effect of moving to a care setting became visible in interaction with disability change ($\beta = -0.14$). Figure 3 shows that moving decreases depressive symptoms among those with increased disability. Moving increases depressive symptoms when there is no significant increase in disability to scores that are above the level of movers with increased disability.

Discussion

In general, we conclude that we have found some support for the PCM: (1) health decline contributes to adjustments in the socio-physical environment, and (2) some of these adjustments buffer the negative effects of disability and health decline on wellbeing, in our case: depressive symptoms.

The results show that, when health problems limit daily life, older adults respond with one or more adaptations in their social and physical environment. A decline in functional capacity was associated with the mobilization of informal care and professional care, more adjustments in the home, and with moving into adapted housing or a residential setting. All these adaptive strategies were more likely to be used by persons with more severe baseline disability and/or a larger increase in disability. This contradicts our expectation that the severity of functional loss in part determines the severity of the adaptation. It can be concluded that the more severe the functional loss, the more likely one or more of the adaptive strategies is used.

Table 2 Linear regression analysis of depressive symptoms at T_2

	Independently living at T_1 – T_2 ($N = 703$)						Moved to care setting at T_2 ($N = 116$)	
	Mobilization of informal care		Mobilization of professional care		More adjustments in the home		β	P
	β	P	β	P	β	P		
<i>T</i> ₁ controls								
Depressive symptoms <i>T</i> ₁	0.46	***	0.47	***	0.46	***	0.45	***
Sex (m, f)	0.10	**	0.09	**	0.10	**	0.09	*
Age (years)	–0.05		–0.06		–0.05		–0.04	
Partner (no,yes)	0.04		0.05		0.05		0.03	
Education (years)	0.02		0.01		0.02		–0.01	
Urbanization (1–5)	0.12	***	0.13	***	0.13	***	0.10	***
Disability <i>T</i> ₁ (0–18)	0.05		0.04		0.04		0.04	
<i>T</i> ₁ informal care (0,1)	–0.02		–0.02		–0.02		–0.01	
<i>T</i> ₁ professional care (0,1)	0.07	*	0.08	*	0.06		0.02	
<i>T</i> ₁ adjustments (0–17)	0.00		0.00		0.00		0.03	
Time-dependent variables								
Lag <i>T</i> ₁ – <i>T</i> ₂ (2.3–4.1)	–0.03		–0.03		–0.03		–0.02	
Partner lost (no, yes)	0.05		0.04		0.04		0.03	
More informal care (0,1)	–0.04		–		–		–	
More professional care (0,1)	–		0.07	~	–		–	
More adjustments (0,1)	–		–		0.03		–	
Moved (0,1)	–		–		–		0.06	
Disability increase (0–19)	0.15	***	0.18	***	0.15	***	0.19	***
Interaction effect ^a	0.09	*	–0.02		0.07	~	–0.14	***

Main and interaction effects of four adaptations

~ $P < 0.10$; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

^a Interaction between *T*₁ disability increase and adaptation (see column header)

The results suggest that the physical environmental adaptations studied need more time to take effect than did mobilizing informal and professional care. The changes in the physical environment also depended on baseline disability, which could indicate a longer time lag between a change in competence and the necessary adjustments. This suggestion is corroborated by the large effect of time between measurements on the probability of moving into a care setting. Other longitudinal studies on the trajectories in the use of care also show that institutionalization usually comes after other, more reversible adjustments (Geerlings et al. 2005; Larsson et al. 2006).

The second research question is based on the assumption that a proper combination of adaptation and functional loss should contribute to higher wellbeing. The fit of the environmental adaptations was evaluated by comparing depressive symptoms at *T*₂ across combinations of disability increase and environmental adaptations, using interaction terms to assess the fit of adaptations to the functional loss. Of the four adaptations studied, two contributed to increased depressive symptoms as expected. The mobilization of informal care diminished depressive symptoms if there was no disability increase, and was associated with a slight increase in depressive symptoms

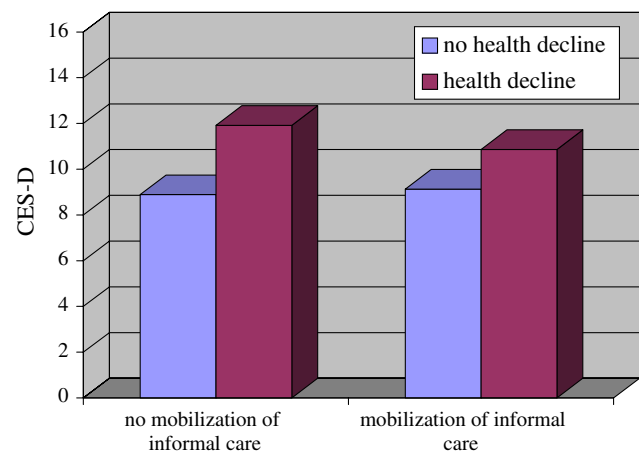


Fig. 1 Mean CES-D scores (*T*₂) for health decline (0 = no change or decrease, 1 = increase of functional disability) and mobilization of informal care (adjusted for sex, age, degree of urbanization, baseline depressive symptoms, and use of formal care at baseline)

among respondents with increased disability. In spite of the severity of the adaptation, moving into a care setting had a clear positive effect on depressive symptoms among those with disability increase, whereas moving increased depressive symptoms when there was no functional loss. This effect was the strongest of the four adaptations

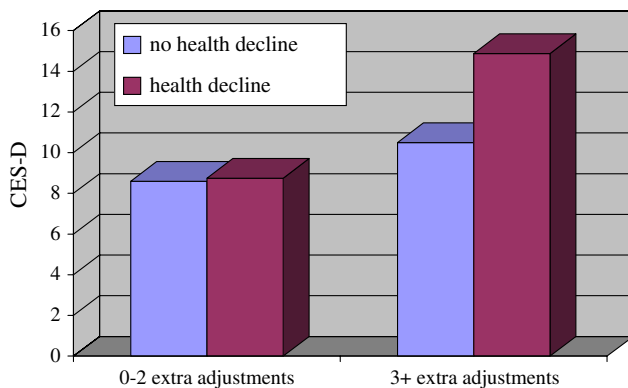


Fig. 2 Mean CES-D scores (T_2) for health decline (0 = no change or decrease, 1 = increase of functional disability) and more adjustments in the home for independently living persons (adjusted for sex, age, degree of urbanization, baseline depressive symptoms, and baseline use of professional care)

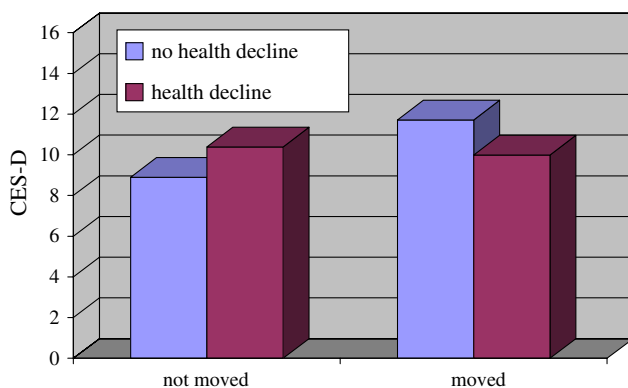


Fig. 3 Mean CES-D scores (T_2) for health decline (0 = no change or decrease, 1 = increase in functional disability) and move to a care setting between T_1 and T_2 (adjusted for sex, age, degree of urbanization, baseline depressive symptoms, and baseline use of professional care)

Mobilizing professional care did not decrease depressive symptoms. On the contrary, professional care appeared to increase depressive symptoms. Apparently, receiving more professional care means more than decreasing the environmental demands. Functional loss brings on feelings of dependency, which may be exaggerated by using professional care, more so than by using informal care (Hellström et al. 2004). Although we controlled for baseline depressive symptoms, there may also be a reverse relationship involved, in which more depressed older adults receive more professional care because they are less able to cope with their functional loss themselves and may have smaller informal networks to turn to for help.

Home adjustments weakly moderated the effect of functional loss on wellbeing, but in the opposite direction from what was expected: introduction of more adjustments among those with increased disability augmented depressive symptoms. Again, this points to the

complexity of needing and receiving care. Given the positive effect of moving after functional loss, it could be that people making many adjustments in the house are actually waiting for a place in a care setting after having applied for admission. Waiting lists and admission procedures were very lengthy in the Netherlands at the time of the study (VWS 1999). There could also be an indirect effect of professional care, as about half the respondents who mobilized professional care also made more adjustments in the house. We considered moving into a care setting an adjustment of the physical environment, but it is more likely a combination of social and physical adjustments; many movers reported also housing adjustments and the mobilization of professional care. These social and physical adjustments in a care setting may come as natural, whereas adjustments in the home where one has been living independently for a long time seem detrimental to wellbeing.

Although the focus is on functional loss and adaptive strategies, there are some interesting results regarding the control variables in the analyses. Partner status showed contrasting effects on the adaptation strategies. Those with a partner were more likely to mobilize informal care (probably the spouse), yet less likely to mobilize professional care or move to a care setting. Losing a spouse was an important predictor for moving to a care setting, and increased the likelihood of mobilizing formal care and home adjustments. Although the results were non-significant among the non-movers, they support the notion that having a partner delays the mobilization of professional care (Geerlings et al. 2005). Partner status had no direct effect on depressive symptoms in Table 2, which contradicts the well-known finding that singles are more often depressed than married persons (Beekman et al. 1995). These findings suggest that adaptation strategies and their outcome may differ between single and married older adults. Further examination of the PCM model should differentiate the strategies and outcomes by partner status.

Another interesting finding concerns the effect of urbanization on the adaptation strategies. In lower urbanized areas adults more often mobilized informal care and home adjustments. This supports other studies showing that personal networks are larger in low-urbanized areas (Van der Meer 2006), and that the availability of residential care is lower in low-urban areas (RIVM 2006) resulting in postponing residential placement. Adaptation strategies may thus vary by the availability of informal and professional care. This suggests that the range of optimal behaviours may be limited due to the restrictions in the social environment. In fact, the choice of individual adaptive strategies may

not be as voluntary as the PCM model suggests. Some of the strategic adaptations can be forced upon the individual. Moving to a care setting may be an optimal strategy, but when waiting lists are restraining this option, staying at home with professional care and home adjustments may not be the optimal fit and lead to lower levels of wellbeing.

One remark has to be made about the limitations of the study. Our choice of adaptive strategies is rather broad and unspecified, as is the operationalization of disability. For example, we did not use information on the type of adjustments made in the house, nor did we specify what type of care was provided by informal sources. This limits the clinical relevance of the present study. The strategies may need to be linked more specifically to the specific type of disability of the person in question (Gitlin 2003). A recent study by Iwarsson (2005) investigated in detail the fit between a person's capacity and the physical environment of the residence they lived in. Decreased fit after a few years was due to a decline in health and the absence of environmental changes in response to the health decline. In our study, we were able to validate the PMC across different levels of functional loss and across individual adaptations. We found that functional loss following health decline was strongly related to changes in the socio-physical environment, but only some of these changes (in particular, the adjustment in the house and move into a care setting) can be interpreted as improving the person-environment fit. A more detailed approach could help to further analyse the way in which such an effect can occur, and would have to include distinguishing between the many social and physical changes involved in a move to a care setting. More attention should also be given to combinations of adaptations and their effect on wellbeing. Another avenue could be to include individual preferences in the assessment of the person-environment fit (Oswald et al. 2005), in order to distinguish better between personal coping styles and tastes as mediators between adaptations and wellbeing.

There is a wide variety of possible indicators of wellbeing or affect to evaluate the person-environment fit in the PCM. Lawton (1982b) used a six-dimensional measure. The use of the CES-D has the advantage of giving a general, well-validated indication of older adults' positive and negative affect. Other wellbeing indicators, such as loneliness or life satisfaction, involve an evaluation of (restricted) areas of life. Still, studies using other indicators are needed to confirm the robustness of our findings.

To conclude, the PCM model has good heuristic value, as it is important not only to look at associations

between needs and ways of responding to these needs, but also to evaluate these responses. Using proper operationalization of the PCM model in other longitudinal and population based studies will enhance our understanding of the importance of the socio-physical environment in late life.

Acknowledgments This study is based on data collected in the context of the "Living arrangements and social networks of older adults" and "Longitudinal Aging Study Amsterdam" research programs. These programs are conducted at the Vrije Universiteit in Amsterdam and the Netherlands Interdisciplinary Demographic Institute in The Hague, and are supported by the Netherlands Program for Research on Ageing (NESTOR) and the Ministry of Health, Welfare, and Sports.

References

- Balfour JL, Kaplan GA (2002) Neighborhood environment and loss of physical function in older adults: evidence from the Alameda County Study. *Am J Epidemiol* 155:507–515
- Beekman ATF, Kriegsman DMW, Deeg DJH, van Tilburg W (1995) The association of physical health and depressive symptoms in the older population: age and sex differences. *Social Psychiatry Psychiatr Epidemiol* 30:32–38
- Boerma GW, Groenwegen PP, Van der Zee J (1998) General practice in urban and rural Europe: the range of curative services. *Soc Sci Med* 47:445–453
- Braam AW, Prince MJ, Beekman AT, Delespaul P, Dewey ME, Geerlings SW, Kivela SL, Lawlor BA, Magnusson H, Meller I, Peres K, Reischies FM, Roelands M, Schoevers RA, Saz P, Skoog I, Turrina C, Verspoort A, Copeland JR (2005) Physical health and depressive symptoms in older Europeans. Results from EURODEP. *Br J Psychiatry* 187:35–42
- Deeg DJH, Knipscheer CPM, van Tilburg W (1993) Autonomy and wellbeing in the aging population. Concepts and design of the longitudinal aging study Amsterdam. Netherlands Institute of Gerontology, Bunnik (NIG Trendstudies no. 7)
- Deeg DJH, van Tilburg T, Smit JH, de Leeuw ED (2002) Attrition in the Longitudinal Aging Study Amsterdam: the effect of differential inclusion in side studies. *J Clin Epidemiol* 55:319–328
- Geerlings SW, Pot AM, Twisk JWR, Deeg DJH (2005) Predicting transitions in the use of informal and professional care by older adults. *Ageing Soc* 25:111–130
- George LK (1996) Social factors and illness. In: Binstock RH, George LK (eds) *Handbook of aging and the social sciences*, 4th edn. Academic, Orlando, pp 229–252
- Gitlin LN (2003) Conducting research on home environments: lessons learned and new directions. *Gerontologist* 43:628–637
- Hellström G, Persson G, Hallberg IR (2004) Quality of life and symptoms among older people living at home. *J Adv Nurs* 48:584–593
- Iwarsson S (2005) A long-term perspective on person-environment fit and ADL dependence among older Swedish adults. *Gerontologist* 45:327–336
- Jacobson NS, Truax P (1991) Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. *J Consult Clin Psychol* 59:12–19
- Knipscheer CPM, de Jong Gierveld J, van Tilburg TG, Dykstra PA (eds) (1995) *Living arrangements and social networks of older adults*. VU University Press, Amsterdam

- Knipscheer CPM, Broese van Groenou MI, Leene GJF, Beekman ATF, Deeg DJH (2000). The effects of environmental context and personal resources on depressive symptomatology in older age: a test of the Lawton model. *Ageing Soc* 20:183–202
- Lang FR (2000) Endings and continuity of social relationships: maximizing intrinsic benefits within personal networks when feeling near to death. *J Soc Pers Relat* 17:155–182
- Larsson K, Thorslund M, Kåreholt I (2006) Are public care and services for older people targeted according to need? Applying the behavioural model on longitudinal data of a Swedish urban older population. *Eur J Ageing* 3:22–33
- Lawton MP (1980) Environment and aging. Brooks/Cole, Monterey
- Lawton MP (1982a) Competence, environmental press, and the adaptation of older people. In: Lawton MP, Windley PG, Byerts TO (eds) *Aging environment*. Springer, Berlin Heidelberg New York, pp 33–59
- Lawton MP (1982b) The varieties of wellbeing. *Exp Aging Res* 9:65–72
- Lawton MP, Nahemov L (1973) Ecology and the aging process. In: Eisdorger C, Lawton MP (eds) *Psychology of adult development and aging*. American Psychology Association, Washington DC pp 619–674
- Oswald F, Hieber A, Wahl HW, Mollenkopf H (2005) Ageing and person-environment fit in different urban neighbourhoods. *Eur J Ageing* 2:88–97
- Pot AM, Deeg DJH, Twisk JWR, Beekman ATF, Zarit SH (2005) The longitudinal relationship between the use of long-term care and depressive symptoms in older adults. *Gerontologist* 45:359–369
- Radloff LS (1977) The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* 3:385–401
- RIVM (2006) *Nationale Atlas Volksgezondheid (National Geographical Map Population Health)*, Bilthoven, The Netherlands: RIVM, online available at <http://www.rivm.nl>
- Schwarzer R, Leppin A (1991) Social support and health: a theoretical and empirical overview. *J Soc Pers Relat* 8:99–127
- Speare A, Avery R, Lawton L (1991) Disability, residential mobility, and changes in living arrangements. *J Gerontol* 46:S133–S142
- Speer DC (1999) What is the role of two-wave designs in clinical research? Comment on Hageman and Arrindell. *Behav Res Ther* 37:1203–1210
- Van der Meer MJ (2006) *Older adults and their sociospatial integration in the Netherlands*. Dissertation, Netherlands Geographical Studies no. 345. Amsterdam Institute for Metropolitan and International Development Studies, Amsterdam
- Van Tilburg TG, Broese van Groenou MI (2002) Network and health changes among older Dutch adults. *J Soc Issues* 58:697–713
- VWS (Ministry of Health, Welfare, Sports) (1999) *Plan van aanpak. Wachttijsten in de verpleging en verzorging*. Den Haag, VWS, The Netherlands
- Wahl HW, Lang F (2004) Aging in context across the adult life: integrating physical and social environment perspectives. *Annu Rev Gerontol Geriatr* 23:1–33