Promoting well-being in frail elderly people

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How to measure Self-Management Abilities in older people by self-report: the development of the SMAS-30

In this Chapter, the results are reported of two studies carried out in order to design and test a self-report instrument to measure Self-Management Ability (SMA) in aging individuals. SMA indicates the core behavioral and cognitive abilities which contribute to sustainable well-being in later life. Robust findings of the studies (n = 275 and n = 1338) showed that SMA could be measured reliably as an overall concept of abilities systematically linked to dimensions of well-being in adults aged 65 and over, with the different subscales revealing a profile of interrelated abilities. In a subsample of Study 2 (n = 86), it was shown that the SMAS-30 exhibited high test-retest stability over a period of 16 weeks. The validity of the SMAS-30 was supported by meaningful associations with other constructs in both studies. As expected, the older and frailer people were, and the poorer their perceived health, the lower was their SMA. Moreover, SMA was positively related to several dimensions of subjective well-being and the related concepts of general self-efficacy and mastery. In addition, the SMAS-30 had its own unique predictive value for the positive dimension of well-being.

This Chapter is based on:

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2.1 Introduction

In recent years, it has been increasingly acknowledged that aging well is not only a matter of having the right genes, but also of how individuals self-regulate or self-manage their own lives and aging. This self-regulation is often mainly related to the physical health aspects of aging, such as exercise and diet [see, e.g., 1-3]. However, social and psychological aspects of life, such as having social contacts, adaptation, and well-being, have proven to be just as important for elderly people to 'age well' [4]. It may be important for aging individuals to self-regulate also in the social and psychological domains in order to contribute to the realization and maintenance of their own overall subjective well-being. Despite the acknowledgement of people's own contributions to the process of aging well, and despite the existence of psychosocial theories about 'successful aging' [see e.g., 5-9] , it is remarkable that there are relatively few suggestions as to how elderly people can be more self-regulating with respect to their general and sustainable well-being [10]. In addition, there are no concrete guidelines for the evaluation of this self-regulation. One important reason for this is that most successful aging models do not specify the criteria for 'success' in their theoretical model and therefore do not specify where the self-regulating strategies should be directed at in order to age successfully [10]. In the existing literature, several measurement instruments can be found to measure well-being or life-management strategies [e.g., 11], but an instrument to measure self-regulating abilities in relation to well-being is not to be found. It seems necessary to have sound measurement instruments for self-regulating mechanisms relating to well-being, for instance, to evaluate the effectiveness of interventions aimed at self-regulation and well-being, or for diagnostic and prospective research. Therefore, it seemed necessary to develop a new instrument to measure these abilities by which elderly people realize and sustain their well-being.

In this Chapter, the development of a scale for measuring life-management or self-management abilities to realize well-being in aging individuals is presented, as well as empirical evidence for the reliability and validity of the scale. The scale is based on the theory of successful self-management of aging (SSMA theory), a theory that offers concrete guidelines on how people can be more self-regulating with respect to well-being [10]. The theory is based on the theory of 'social production functions' (SPF theory) [12,13]. The SSMA theory is described in Chapter 1 (see 1.3.1). Shortly, the theory specifies 6 self-management or adaptive abilities (multifunctionality of resources, variety of resources, having a positive frame of mind, investment behavior, self-efficacy, and taking initiatives) that are directed at the realization of 5 substantive goals for well-being (comfort, stimulation, affection, behavioral confirmation, and status). Because well-being is achieved through realization of the five substantive goals, every ability should explicitly be seen in the light of each of these substantive goals or dimensions of well-being. Examples are taking the initiative with regard to comfort, or being self-efficacious with respect to receiving and giving affection. Only when the abilities are directed at each of the substantive dimensions of well-being do they contribute to successful self-management of aging. Where other successful aging theories [see, e.g., 5-9] only define abilities or strategies, the SSMA theory defines both

the abilities and the dimensions of well-being at which these abilities can best be directed to age successfully. Because in this way the criterion for 'success' (well-being) is integrated in the theoretical model, successful aging can be measured and concrete guidelines to improve successful aging can be given.

Although, theoretically, six self-management abilities are distinguished, they are not assumed to be independent. Often, several abilities are at work at the same time and reinforce each other. For instance, having a positive frame of mind promotes investment behavior, and being self-efficacious promotes taking initiative. Therefore, it is assumed that the six abilities all contribute to one underlying dimension, namely, SMA. We regard SMA as one latent construct to which several abilities systematically linked to dimensions of well-being contribute.

2.1.1 Overview of the research and expectations

The six self-management abilities systematically linked to the five dimensions of well-being were integrated into a matrix which was then taken as the basis for the design of the instrument for SMA (see Table 2-1). As such, the scale was constructed from the SSMA theory that defines the systematic link of abilities to dimensions of well-being. This integration implies that each self-management ability was given 'content' by connecting it with the five main dimensions of well-being: comfort, stimulation, affection, behavioral confirmation, and status. Two abilities deviated from this principle. Multifunctionality, by definition, refers to more than one dimension of well-being at the same time; positive frame of mind deviated because it was considered to be a more general cognitive ability and difficult to apply to the specific dimensions of well-being. Therefore, the items for positive frame of mind were formulated in more general terms.

Table 2-1. Self-Management Abilities systematically linked to dimensions of well-being (The numbers in the cells are the numbers of the items, corresponding to Appendix I)

	Comfort	Stimulation	Affection	Behavioral confirmation	Status
Multifunctionality					
Variety	2	1	4	5	3
Positive Frame of Mind					
Investment	5	2	3	1	4
Self-efficacy	4	2	3	5	1
Taking Initiatives	4	3	1	2	5

As mentioned above, it was expected that the six abilities systematically linked to the dimensions of well-being would constitute one overall dimension of SMA. Therefore, our main focus was on the development of an instrument to measure overall SMA. However, we also used the abilities as separate subscales in order to allow the specific measurement of a profile of different abilities, which is useful for a detailed evaluation of SMA. Below, two studies of the concrete development and testing of the

measurement of SMA are described. In the first study, the design study, a large pool of items to measure SMA was designed and tested in a pilot sample of people aged 65 years and older. On the basis of this developmental study, a final instrument – the SMAS-30 – was determined. The design study also addressed the validity of the scale. In the second study, the test and validation study, the final instrument was tested in a large sample of community-dwelling elderly people of 65 years and older. In the test and validation study, the measurement model of the scale was also tested using Confirmatory Factor Analysis. Finally, test-retest reliability and further validity of the instrument were investigated.

To find evidence for the validity of the SMAS, we investigated concepts to which SMA was expected to be related in both studies. These included age, frailty, perceived health, subjective well-being, general self-efficacy, and mastery. SMA and age were expected to be negatively related. Chronological age can be seen as a proxy for all kinds of losses and deficits which occur in aging. These losses, in turn, are related to decreasing SMA. Level of SMA was also expected to be negatively related to level of frailty. Frailty means loss of direct resources in several domains of functioning [14,15]. SMA may prevent or retard this loss, because self-management abilities deal with declining direct resources. Thirdly, higher SMA was expected to be related to better perceived health. Perceived health can be seen as part of the well-being dimension, 'comfort', which is supposed to be fostered by SMA. Lastly, we expected that higher SMA would be related to more positive well-being (positive affect, life satisfaction, and overall well-being) and to less 'negative well-being' (negative affect and psychological distress), because self-management abilities are abilities that foster the realization of well-being.

As there were no concepts that completely overlapped with SMA, this kind of validity could only be investigated approximately. A partly overlapping construct was general self-efficacy, which was expected to be related to SMA because SMA also includes aspects of self-efficacy. Another partly overlapping construct was mastery. We expected that people with high SMA would feel more in control of their lives and, therefore, would have a higher sense of mastery.

2.2 Study 1: Designing the SMAS-30

2.2.1 Method

Design of items

A pool of 74 items was formulated by an expert panel, based on the SSMA theory described above. For every 'cell' of the matrix (see Table 2-1) several equivalent items were designed, to make it possible to choose the best ones after testing of these items. Each item measured an ability, mostly in relation to a specific dimension of well-being. We tried to cover the full range of every well-being dimension and used the activities that the expert panel thought would be appealing to most people. For items relating to social well-being, the item content was also based on the results of several focus groups and other qualitative research on how people realize and experience social well-being [16]. The 74 items were tested in a pre-pilot of 10 elderly persons. Some questions were adapted on the basis of the results of this pre-pilot.

The Taking Initiatives, Investment, and Self-efficacy dimensions (subscales) each consisted of 15 items. An example of Taking Initiatives regarding comfort was 'How often are you engaged in making your home or room as comfortable as possible?', with answers on a six-point Likert-scale from '*never*' to '*very often*'. Investment consisted of items such as 'Do you ensure that you have enough interests on a regular basis (such as a hobby) to keep you active?' (stimulation), with the same answers as for Taking Initiatives. For Self-efficacy, we asked about the confidence that people have in their own capacities for realizing well-being, such as 'Are you able to have friendly contacts with others?' (behavioral confirmation). Answers here were on a continuum from 1 to 10, with 1 meaning '*I am certain I cannot*' and 10 meaning '*I am completely certain I can*'. The Variety dimension consisted of 14 items. An example of an item for this subscale was 'With how many people do you have a confidential relationship?' (affection), with answers '*none*', '*one*', '*two*', and '*three or more*'. The Multifunctionality dimension consisted of eight items, each item formulated over two or more dimensions of well-being, such as 'The activities I enjoy, I do together with others.' (behavioral confirmation, stimulation). The answers were on a five-point Likert-scale from '*strongly disagree*' to '*strongly agree*'. Positive Frame of mind, finally, consisted of seven items which were not related to specific dimensions of well-being, such as 'When you have a bad day, how often do you think that things will be better tomorrow?'. The answers were on a six-point Likert-scale from '*never*' to '*very often*'.

Respondents

People aged 65 years and older were recruited between September and December 2000 from two wards of Internal Medicine of the University Hospital Groningen (The Netherlands), from homes for the elderly, sheltered accommodation, and recreational clubs for elderly persons. We recruited people from several diverse sites to make our sample as broad and representative as possible, including both healthy and unhealthy

elderly people. Respondents were excluded if they were too ill, cognitively impaired, or too much hindered in communication because of visual problems, deafness, or aphasia. The sample of respondents consisted of 275 elderly persons. The mean age was 78.4 years (*SD* = 7.05), with ages ranging from 64 to 99 years. Of the respondents, 72.4% were women, 58.2% were living alone, and 82.8% were living independently (i.e., not in a residential or nursing home). The majority of the respondents filled out the questionnaires themselves; 18.5% of the respondents were not able to do this (because of visual handicaps, inability to write because of rheumatoid arthritis, and the like) and were, therefore, interviewed.

Measures

Frailty was measured using the Groningen Frailty Indicator (GFI) [14,15], a short, easy-to-administer 15-item screening instrument to determine a person's level of frailty (*KR-20* = .76). The GFI screens for the loss of resources in several domains of functioning (physical, cognitive, social and psychological). The scores range from 0 (not frail) to 15 (severely frail). *Perceived health* was measured using the SF-20 subscale of general health perceptions [17]. A higher score indicates better perceived health (α = .86). *Life satisfaction* was measured using Cantril's ladder [18], a 10-point rating scale in the form of a ladder on which people have to rate where they consider themselves to be positioned between the worst imaginable life (0) and the best imaginable life (10). *Psychological distress* was measured using the 12-item version of the General Health Questionnaire (GHQ) [19]. A higher score on this scale indicates more psychological distress (α = .90). As a partly overlapping construct, *general self-efficacy* was measured using a 12-item Dutch version of Sherer's Self-Efficacy Scale [20]. A higher score indicates a higher sense of general self-efficacy (α = .75). In addition, age, partner status, and living situation were measured.

Analysis

Items were removed from the original pool following several criteria. Firstly, items were removed that were either not well understood by the respondents, had more than 10 percent missing values, or had a skewed distribution. Secondly, the best items per subscale were chosen, following three criteria: the five dimensions of well-being should (where applicable) be represented in the items; every subscale should be sufficiently reliable; and there should be as few items as possible, without loss of content and psychometric quality. The selection following these criteria resulted in 30 items (5 per subscale). The items which were finally selected seemed to represent SMA best on theoretical grounds and had good internal consistency (see below and Table 2-2).

The reliability of the 30 items together was investigated using Cronbach's alpha, and a Mokken Scale Analysis and Principal Component Analysis (PCA) were carried out on these items together. Mokken Scale Analysis for polytomous items is a non-parametric probabilistic item-response model which tests whether the scale is cumulative and measuring a single trait, representable as a uni-dimensional continuum [21]. The first

Table 2-2. Descriptive statistics for subscales and total SMAS-30, for Study 1 and Study 2

	Study 1 (n = 275)		Study 2 (n = 1338)	
Scale	Mean (SD)	α[a]	Mean (SD)	α[a]
Multifunctionality	73.2 (23.7)	.71	71.2 (23.4)	.74
Variety	66.3 (19.8)	.67	54.4 (16.6)	.72
Positive Frame of Mind	60.0 (16.2)	.83	58.2 (16.3)	.84
Investment Behavior	56.9 (15.5)	.75	59.5 (14.2)	.72
Self-efficacy	70.4 (16.8)	.82	74.6 (14.2)	.73
Taking Initiatives	50.5 (15.4)	.72	54.5 (14.4)	.75
Total SMAS-30	63.3 (13.5)	.91[b]	62.4 (12.3)	.91[b]

a. α is standardized item alpha.

b. The α for total SMAS-30 is the α of all items together.

Mokken model concerns 'monotone homogeneity' (MH), which implies that the probability of a positive response to the items increases when the value of the subject on the latent trait increases[1]. Mokken Scale Analysis also gives scalability criteria, Loevinger's H. An H lower than .30 indicates that the items do not form a scale, an H between .30 and .40 indicates a weak scale, an H between .40 and .50 indicates a medium scale, and an H above .50 indicates a strong scale.

Thirdly, reliability analyses were carried out for each subscale, considering inter-item correlations, item-total correlations, and Cronbach's alphas. In addition, the factorial structure of the subscales was investigated using PCA and Mokken Scale Analysis. The scores on the 30 items were transformed to a 20-point scale. For every subscale, a sum score was computed by summing the scores of the items selected for this scale. Correlations were calculated between the subscales. PCA and Mokken Scale Analysis were carried out using the subscale scores. Finally, the overall SMA score was computed by taking the mean of the subscale scores.

To investigate validity, correlations were calculated between the overall score and the other measures. In addition, hierarchical regression analyses were carried out using either psychological distress or life satisfaction as the dependent variable, age, frailty and perceived health as control variables in the first step, general self-efficacy as predictor in the second step and SMA as predictor in the third step. All analyses were carried out using SPSS 10.0.7 [22], except for the Mokken Scale Analyses, which were carried out using MSPWin 5.0 [23].

1. The second model, the model of 'double monotonicity' (DM), is a more restricted model and tests whether the order of probabilities of positive responses to all items is the same for all subjects. This second model was less important here, because we primarily wanted to investigate the uni-dimensionality of the scales and did not expect an order in the difficulty of the items.

2.2.2 Results

Reliability and factorial structure of all items

The 30 items together had a high internal consistency (α = .91). A PCA of all items revealed 8 components with Eigenvalues larger than 1, the first two of which were strong and interpretable components with Eigenvalues of 8.94 and 2.50, respectively, and explained variances of 29.8% and 8.3%. All items loaded high on the first unrotated component (all loadings higher than .30), but 4 of the 5 items of Positive Frame of Mind loaded somewhat higher on the second component. This did not come as a surprise, since Positive Frame of Mind seems to be a self-management ability which is slightly different from the other self-management abilities, as it is not directly connected to the dimensions of well-being. To see whether components could be discriminated more clearly from each other (be more interpretable), a Direct Oblimin Rotation was applied, which allowed the components to correlate. The rotated solution showed a separate component for Positive Frame of Mind, Multifunctionality, Self-Efficacy (4 items), and five components grouping together items from several different subscales. This rotation showed that the factorial structure of the scale was given by both the abilities and the dimensions of well-being, but that the abilities contributed more strongly.

The factorial structure of all items together was further investigated using Mokken Scale Analysis for polytomous items. This analysis scaled 27 of the 30 items together, forming a weak (H = .30), but still MH scale. When forced to scale the three excluded items with the others, Loevinger's coefficient only decreased to .29, which is just sufficient to form a scale. The 30-item scale was still MH. This implies that at least 27 of the 30 items could be regarded as forming one dimension and also that all 30 items together could be used to measure and order respondents based on the ordinal latent trait of SMA.

Reliability of the subscales

Table 2-2 shows descriptive statistics for all subscales. A higher score indicates more of a certain self-management ability. For every subscale, the percentage of missing values for these items ranged from .7% to 6.2% . Cronbach's alphas for the subscales were satisfactory and ranged from .67 to .83. All subscales were approximately normally distributed.

Factorial structure of the subscales

The factorial structures of all subscales were investigated separately using PCA. All subscales revealed one component (Table 2-3), with explained variances between 44.0% and 60.3%, and all component loadings above .40. Dimensionality of the subscales was also investigated using Mokken Scale Analysis. All subscales fulfilled the

criteria of MH, so they can be considered one-dimensional. Multifunctionality, Variety, Investment, and Taking Initiatives were weak scales according to the criteria for Loevinger's scaling coefficient (Table 2-3). Self-efficacy formed a medium scale. Positive Frame of Mind formed a strong scale.

Table 2-3. Component loadings (PCA) and scaling coefficients H_i (Mokken Scale Analyses) for items of subscales SMAS-30, Study 1 (n = 275) and Study 2 (n = 1338)

	Multifunctionality				Variety				Positive Frame of Mind			
	Study 1		Study 2		Study 1		Study 2		Study 1		Study 2	
item	loading[a]	H_i[b]	loading	H_i	loading	H_i	loading	H_i	loading	H_i	loading	H_i
1	.68	.35	.75	.44	.79	.41	.79	.43	.74	.52	.75	.54
2	.69	.34	.65	.40	.59	.30	.67	.35	.79	.55	.81	.57
3	.75	.38	.72	.40	.71	.36	.75	.41	.78	.53	.79	.55
4	.65	.33	.62	.35	.48	.27	.49	.26	.77	.52	.77	.53
5	.62	.33	.76	.47	.71	.36	.73	.39	.81	.55	.78	.54
H[c]		.35		.41		.35		.37		.53		.55
Eigenvalue	2.31		2.48		2.20		2.40		3.01		3.05	
Explained variance	46.3%		49.6%		44.0%		48.0%		60.3%		60.9%	

	Investment				Self-efficacy				Taking initiatives			
	Study 1		Study 2		Study 1		Study 2		Study 1		Study 2	
item	loading	H_i	loading	H_i	loading	H_i	loading	H_i	loading	H_i	loading	H_i
1	.76	.44	.60	.31	.62	.36	.67	.39	.70	.39	.74	.43
2	.76	.45	.78	.45	.79	.48	.75	.43	.74	.45	.80	.47
3	.75	.44	.70	.39	.82	.50	.71	.39	.76	.43	.75	.44
4	.75	.43	.77	.42	.75	.45	.59	.33	.66	.33	.62	.36
5	.51	.28	.62	.33	.85	.53	.75	.42	.57	.26	.64	.37
H		.40		.38		.46		.39		.37		.41
Eigenvalue	2.54		2.42		2.96		2.43		2.38		2.53	
Explained variance	50.9%		48.5%		59.2%		48.6%		47.8%		50.6%	

a. loading is PCA loading.

b. H_i is scaling coefficient item.

c. H is scaling coefficient total scale. Scaling Coefficient: $30 \leq H_i < 40$ means a weak scale; $40 \leq H_i \leq 50$ means a medium scale; > 50 means a strong scale.

Correlations between the different subscales of the SMAS ranged from .25 to .69 (mean correlation .46) and were all significant at the 0.01 level, two-tailed. Especially Taking Initiatives, Investment, and Variety correlated strongly (between .59 and .69), as did Multifunctionality and Variety (.57). As expected, the abilities are related to each other, but do not measure the same ability.

Overall scale as the mean of the subscale scores

A PCA was carried out on the sums of the subscales, revealing one strong component with an Eigenvalue of 3.44, explained variance of 57.4%, and component loadings ranging from .54 to .84 (Table 2-4). This indicates that the overall SMA score as the mean of the subscale sums is a strong measure of the underlying dimension of SMA. This one-dimensionality of the overall SMAS was also confirmed using Mokken Scale Analysis[2] (Table 2-4). The sums together formed a medium, MH scale. The overall SMAS scores were normally distributed. Internal consistency of the overall SMAS was high (α = .85). Both PCA and Mokken showed that Positive Frame of Mind scaled lowest with the overall scale, which is in agreement with the findings of the factorial structures of the 30 separate items.

Table 2-4. Component loadings (PCA) and scaling coefficients H_i (Mokken Scale Analysis) over subscale scores SMAS-30, for Study 1 (n = 275) and Study 2 (n = 1338)

	Study 1		Study 2	
item	loading	H_i	loading	H_i
Multifunctionality	.71	.44	.65	.40
Variety	.82	.46	.80	.50
Positive Frame of Mind	.54	.34	.56	.33
Investment Behavior	.84	.50	.85	.52
Self-efficacy	.78	.46	.80	.52
Taking Initiatives	.82	.54	.84	.52
Total SMAS (H)[a]		.46		.46
Eigenvalue	3.44		3.45	
Explained Variance	57.4%		57.5%	

a. With Mokken Scale Analysis, for both samples the total SMAS-30 was MH.

2. Because Mokken Scale Analysis for polytomous items can only scale items with up to 10 ranked response options, subscale scores were brought back to the original sums (thus without transformation to a 20-point scale).

Relations with other concepts

As expected, correlations between SMA and age, frailty, perceived health, life satisfaction, and psychological distress, were all highly significant and in the expected direction. The older people were, the lower their SMA was (r = -.36, $p < .001$). A higher level of SMA was also significantly associated with less frailty (r = -.44, $p < .001$), better perceived health (r = .34, $p < .001$), higher life satisfaction (r = .46, $p < .001$), and a lower level of psychological distress (r = -.30, $p < .001$).

Table 2-5. Two hierarchical regression models predicting Psychological Distress (GHQ) and Life Satisfaction (Cantril's Ladder), Study 1

		Psychological Distress	Life Satisfaction
	Variable	β (p)	β (p)
Step 1	Frailty	.28 (.001)	-.31 (< .001)
	Age	-.05 (.467)	.08 (.182)
	Perceived Health	-.40 (< .001)	.44 (< .001)
	Adj. R^2	.35	.45
Step 2	Frailty	.21 (.009)	-.25 (.002)
	Age	-.07 (.284)	.10 (.087)
	Perceived Health	-.40 (< .001)	.44 (< .001)
	General Self-efficacy	-.21 (.001)	.20 (.001)
	Adj. R^2	.39	.48
	R^2 changed	.039	.033
	Sig. F Change	.001	.001
Step 3	Frailty	.22 (.008)	-.21 (.004)
	Age	-.06 (.399)	.16 (.006)
	Perceived Health	-.41 (< .001)	.39 (< .001)
	General Self-efficacy	-.23 (.002)	.08 (.246)
	SMA	.04 (.583)	.27 (< .001)
	Adj. R^2	.39	.52
	R^2 changed	.001	.044
	Sig. F change	.583	< .001

SMA had a moderate, significant correlation with a partly overlapping concept, general self-efficacy (r = .49, $p < .001$). This correlation was larger than the correlations between SMA and non-overlapping concepts (such as well-being), which gives evidence for the validity of the SMAS-30. SMA did not explain a unique portion of the variance of psychological distress once the control variables and general self-efficacy

were included (Table 2-5). However, SMA uniquely contributed to the explained variance of life satisfaction and even removed the significant effect of general self-efficacy. This indicates that the concept of SMA (partly) differentiates itself from self-efficacy and that it contributes uniquely to the prediction of certain concepts.

2.2.3 Conclusions and discussion of Study 1

The results of Study 1 show that it is possible to measure the overall concept of SMA using an overall scale to which the different abilities and dimensions of well-being contribute. The overall score refers to one dimension and forms a medium-strong scale with good internal consistency. In addition, the six self-management abilities (dimensions) form interrelated one-dimensional subscales with good internal consistency. Thus, SMA as an overall concept can be measured reliably, whereas the subscales reveal a profile of interrelated self-management abilities contributing to the overall concept. Some self-management abilities are less (inter)related with others, indicating that they seem to be more distinct from others. This concerns Positive Frame of Mind.

The final scale, the SMAS-30, seems to be a promising self-report questionnaire for measuring SMA in elderly people. Significant correlations with related constructs provide evidence for the validity of the scale. For validity, the correlation and regression coefficient with general self-efficacy, a construct partly overlapping with SMA, is also important to consider. The magnitude and the direction of the correlation show that both measure aspects of the same underlying construct, but the overlap is not large enough to conclude that they measure the same thing. The SMAS-30 adds something new, especially in predicting the positive dimension of well-being (life satisfaction). This is further evidence of the validity of the SMAS-30.

Limitations

Although the design and first investigations of the SMAS-30 seem to be promising, more research needs to be done to further investigate the usefulness and psychometric properties of the final SMAS-30. The final scale needs to be tested in a community sample to see how the scale works in a general population of people of 65 years and older. Moreover, test-retest reliability of the SMAS-30 needs to be investigated.

To conclude, we decided to continue using this overall scale and its subscales, and to test and further validate the scale in a sample of community-dwelling people of 65 years and older. Based on the results of this first study, we made some small changes in the instrument. The answer categories for three of the subscales were changed, because the variance in scores was too low or the categories were too difficult. For Variety, we extended the Likert-scale with two categories. The category '*three or more*' was changed to '*three or four*', and the categories '*five or six*' and '*more than six*' were added. In addition, the 10-point scale of Self-efficacy was changed into a five-point

Likert-scale (*'I'm sure I cannot'* to *'I'm sure I can'*). Lastly, the formulation of three categories of Multifunctionality was changed slightly, as their formulation seemed to be too complicated. An overview of the final scale (SMAS-30) is given in Appendix I.

2.3 Study 2: Testing the SMAS-30

2.3.1 Method

Respondents

In August 2001, a questionnaire[3] was sent to a random sample of 3,000 community-dwelling elderly persons aged 65 years and older, randomly drawn from the registers of six municipalities in the north of the Netherlands. These municipalities consist of smaller and larger areas and have an income comparable to the national mean. Each municipality selected the addresses of 500 community-dwelling elderly persons aged 65 years and older. A comparison based on gender between this community sample and the Dutch population of 65 years and older [24] showed that the proportion of males to females in both populations was equal, with 41% being male and 59% being female. A total of 45% of the addressees returned the questionnaire (n = 1,338). Though this response rate might seem low, it is comparable [25,26] or even quite high [27-29] compared to similar studies in which a questionnaire was sent by mail.

The proportion of males to females remained about the same as in the community sample. The distribution of the respondents over the six municipalities was about the same as the distribution of the original community sample (about 17% from each municipality). In some cases of non-response, the addressees or family members of the addressees contacted us by phone or letter. This gave us an impression of the reasons why this group did not return the questionnaire: death, admission to a nursing home, poor physical condition, cognitive disorders, too busy, not in the mood, and concerns about privacy.

The average age was 74.2 (*SD* = 6.59), the oldest respondent being 98 years old. At the time of completion, 99% of the respondents was living independently, while 1% had been admitted to a residential home. Sixty-three percent of the respondents had a partner with whom they shared a house, 2% had a partner with whom they did not share a house, and 35% did not have a partner at the time of completion.

3. The questionnaire had four versions, which partly contained different measurement scales. The PANAS and SPF-IL(s) were not administered to the whole sample. Therefore, the numbers of respondents in the analyses are different for the different measurement scales. The PANAS was filled out by 439 people; the SPF-IL(s) by 883 people.

Subsample

Ninety-six of the respondents were sent the SMAS-30 again after 16 weeks. Ninety percent of them returned the questionnaire (n = 86). Reasons for not returning the questionnaires were health problems, and perceiving the questions as unpleasant. The subsample was comparable to the main sample (mean age = 73.7, *SD* = 6.27, age range = 66 – 91 years, 35% male, 68% with partner).

Measures

To measure *frailty*, the same instrument as in the first study was used, namely, the Groningen Frailty Indicator (*KR-20* = .71). Because in Study 1 only life satisfaction and psychological distress were measured, in this second study, all components of well-being were measured: life satisfaction, negative and positive affect, and overall well-being, in which these components were integrated. The cognitive component of subjective well-being, *life satisfaction*, was measured using the Satisfaction with Life Scale (SWLS) [30], a 5-item scale which measures life satisfaction as a cognitive-judgmental process (α = .85). A higher score indicates more satisfaction with life. The affective components of subjective well-being were measured using the Positive Affect Negative Affect Scale , a 20-item scale measuring the positive and the negative affective components of well-being [31]. The Positive Affect Scale (α = .82) consists of 10 items measuring *positive affect* and the Negative Affect Scale (α = .85) consists of 10 items measuring *negative affect*. The higher the sum scores on both subscales, the more positive and the more negative affect, respectively. *Overall subjective well-being* was measured using the Social Production Function Instrument for the Level of well-being, 15-item version [32]. This scale integrates both affective and cognitive components of well-being and measures people's levels of physical and social well-being (α = .84). A higher score indicates more well-being. As a partly overlapping construct, *mastery* was measured using the Pearlin and Schooler mastery scale, a 7-item scale (α = .76) [33]. Mastery was only measured in the subsample. A higher score on this scale indicates a stronger sense of mastery. To measure *perceived health*, the same instrument as in the first study was used, namely, the SF-20 subscale of general health perceptions (α = .81) [17]. Perceived health was only measured in the subsample. In addition, age, partner status, and living situation were measured.

Analysis

The same analyses for the overall scale and the subscales were carried out as in Study 1, namely, reliability analysis, Mokken Scale analysis and PCA. Additionally, the measurement model of the SMAS-30 was tested using Confirmatory Factor Analysis (CFA) using Lisrel 8.3 [34]. We analyzed the covariance matrix using the Maximum Likelihood Method. Missing values were imputed by simple group mean imputation. The indicators in the CFA were the single items.

To investigate test-retest reliability, we calculated the Intraclass Correlation (ICC) (two-way random and absolute agreement) as a measure of agreement between overall SMA on both measurements. Secondly, SMAS-scores on both measurements were placed in

6 categories and Gamma was computed as another measure of agreement. Gamma indicates the difference in proportion of time that two measures have the same ordering minus the proportion of time that their ordering is opposite [35].

Relations with theoretically related concepts were investigated in the same way as in Study 1. To further investigate validity, a Pearson correlation between SMA and mastery was computed. A same kind of hierarchical regression as in Study 1 was done with psychological distress, life satisfaction, and overall wellbeing respectively as the dependent variables and mastery as the predictor. Except for CFA, all analyses were carried out using the same software as was used in Study 1.

2.3.2 Results

Reliability and factorial structure of all items

Cronbach's alpha for all items together was .91, the same as in Study 1. A PCA of all items revealed a pattern comparable to that found in Study 1. A Direct Oblimin Rotation, showing a comparable pattern to that found in Study 1 as well, again indicated that the factorial structure of the scale was given by both the abilities and the dimensions of well-being, but more strongly by the abilities, as expected.

Mokken Scale Analysis scaled 18 of the 30 items together, forming a weak (H = .37) and MH scale. The items of Positive Frame of Mind and those of Multifunctionality both formed separate scales. When forced to scale all 30 items together, Loevinger's coefficient was .28, comparable to the finding in Study 1. This scale was still MH. These results imply that all 30 items together can be used to measure and order respondents on the ordinal latent trait of SMA, though some items may be less indicative of the construct than others.

Reliability of subscales

Cronbach's alphas for the subscales were satisfactory and comparable to the alphas of Study 1 (Table 2-2). The percentage of missing values was small, ranging from 1.6 to 5.7%. Again, the subscales were approximately normally distributed.

Factorial structure of the subscales

The factorial structures of the different subscales were again investigated using PCA and Mokken Scale Analysis. All subscales, except for Investment, revealed one component (Table 2-3), with explained variances between 48.0% and 60.9% and all loadings above .50. Investment revealed a small second component with an Eigenvalue above 1, but factor loadings were mainly highest on the first component. Mokken Scale Analysis showed that all subscales were MH. Variety, Investment, and

Self-efficacy were weak scales, Multifunctionality and Taking Initiatives were moderate scales, and Positive Frame of Mind was a strong scale (Table 2-3). Correlations between subscales ranged from .24 to .76 (mean correlation .48) and were similar to the correlations in Study 1.

Overall scale as the mean of the subscale scores

A PCA again provided evidence for the one-dimensionality of the SMAS-30 as the mean of the subscale scores (Table 2-4), with component loadings and explained variance comparable to those found in Study 1. This was confirmed using Mokken Scale Analysis (Table 2-4), again showing the SMAS-30 as a medium, MH scale. Like in Study 1, Positive Frame of Mind scaled lower than the other abilities. Multifunctionality also scaled a bit lower.

Testing the measurement model using CFA

Firstly, we tested the measurement model of overall SMA using six latent variables, one for every ability, each with five observed variables. Covariances between latent variables were freed, as were error variances of latent and observed variables. To assess the model fit, several indices were used [36-38]. Firstly, the χ^2-goodness-of-fit statistic as a test for exact fit was considered. Because this statistic is dependent upon sample size and because exact fit might not be a realistic assumption, we also used the standardized root mean square residuals (SRMR) as a measure of close fit (a less strict measure than exact fit). The SRMR should preferably be smaller than .08. Thirdly, we used the root mean square error of approximation (RMSEA), a measure of the discrepancy between the population covariance matrix and the model of approximation. The RSMEA should preferably be smaller than .09 to have a reasonable error of approximation and should be below .05 to indicate a close fit. Moreover, the RMSEA should be within its 90% confidence interval. Finally, the incremental fit index (IFI) was considered. This is an index which compares the target model with a more restricted, nested baseline model. The IFI should be at least .90 to indicate that specified relations between the variables are supported by the data; for a good model, it should be .95 or higher.

As can be seen from Table 2-6, the overall model with the six self-management abilities as latent variables did not fit well. The model shows that, although the items were not totally random, much remained unexplained. Therefore, we tested a second overall model that included latent variables for the dimensions of well-being as well.

The indices in Table 2-6 clearly show that the model using both abilities and dimensions of well-being had the best fit, as can be seen from a relatively small χ^2, small residuals as shown by SRMR indicating good global fit, a small RMSEA within its 90% confidence interval, and a large IFI, showing it to be a good model. Together, these CFAs showed that, as expected, the underlying factors of the items were both the abilities and the dimensions of well-being. This means that both abilities and

dimensions of well-being contribute to SMA and that the scale measures the abilities systematically linked to the dimensions of well-being, just like it is specified in the SSMA theory.

Table 2-6. Goodness-of-fit statistics for two separate measurement models tested with Confirmatory Factor Analysis

Model	χ^2	df	p-value	SRMR[a]	RMSEA[b]	90% Confidence Interval of RMSEA	IFI[c]
Abilities	3495.61	390	< .001	.063	.09	.090 - .094	.79
Abilities and dimensions of well-being	1103.61	321	< .001	.033	.04	.041 - .047	.95

a. SRMR is Standardized Root Mean Square Residual.

b. RMSEA is Root Mean Square Error of Approximation.

c. IFI is Incremental Fit Index.

Test-retest reliability

We expected to find stability in the subsample, because SMA might not fluctuate much by nature in a period of 16 weeks. On the other hand, the concept must be sensitive to interventions, thus should not be too stable. The ICC between the two measurements of SMA was .77 ($p < .001$). The ICC indicated that the SMAS-30 was quite a stable measurement scale. The ICC was comparable to those in other studies (e.g., the SOC scale had ICCs of .77, .71, and .76 over a period of 4 weeks [11]). Comparing the measures of SMA divided in six categories revealed a Gamma of .68 ($SE = .07$; $p < .001$). This Gamma also showed that there was good agreement between both measurement moments. The SMAS-30 thus was found to have good stability.

Relations with other concepts

As expected, correlations between overall SMA and age, frailty, and well-being measures were highly significant and in the expected direction. Age had a significant negative relation with SMA ($r = -.23$, $p < .001$). In addition, a higher level of SMA was significantly associated with less frailty ($r = -.42$, $p < .001$), more life satisfaction ($r = .45$, $p < .001$), more overall well-being ($r = .72$, $p < .001$), more positive affect ($r = .66$, $p < .001$), and less negative affect ($r = -.23$, $p < .001$). These relations again lend support to the validity of the scale.

There was a significant but small relation between mastery and SMA ($r = .24$, $p = .039$). SMA did not explain a unique portion of the variance of psychological distress once the control variables and mastery were included (Table 2-7). However, SMA uniquely contributed to the explained variance of life satisfaction and overall

well-being. This indicates that the concept of SMA (partly) differentiates itself from mastery and that it can contribute uniquely in the prediction of certain concepts, especially the positive dimension of well-being.

Table 2-7. Three hierarchical regression models predicting Psychological Distress (GHQ), Life Satisfaction (SWLS), and Overall Well-being (SPF-IL(s)), Study 2

		Psychological Distress		Life Satisfaction		Overall Well-being	
	Variable	β (p)		β (p)		β (p)	
Step 1	Frailty	.29	(.013)	-.32	(.011)	-.15	(.189)
	Age	-.14	(.188)	.04	(.720)	.14	(.194)
	Perceived Health	-.29	(.010)	.07	(.577)	.39	(.001)
	Adj. R^2	.19		.08		.19	
Step 2	Frailty	.20	(.053)	-.29	(.020)	-.12	(.309)
	Age	-.12	(.198)	.04	(.755)	.13	(.220)
	Perceived Health	-.22	(.029)	.05	(.701)	.35	(.002)
	Mastery	-.42	(< .001)	.13	(.268)	.22	(.041)
	Adj. R^2	.36		.08		.23	
	R^2 changed	.16		.015		.044	
	Sig. F Change	< .001		.268		.041	
Step 3	Frailty	.20	(.058)	-.28	(.022)	-.09	(.353)
	Age	-.13	(.194)	.04	(.687)	.15	(.115)
	Perceived Health	-.22	(.030)	.04	(.733)	.32	(.001)
	Mastery	-.41	(< .001)	.06	(.582)	.13	(.181)
	SMA	-.06	(.526)	.27	(.014)	.43	(< .001)
	Adj. R^2	.35		.15		.40	
	R^2 changed	.003		.070		.169	
	Sig. F change	.526		.014		< .001	

2.3.3 Conclusions and Discussion of Study 2

The results of Study 2, in which the SMAS-30 was tested in a large community sample, confirm the reliability of the scale which was found in Study 1, as well as the one-dimensional structure of overall SMA as the mean of the sums of the subscales which was found using PCA and Mokken Scale Analysis. A CFA of the measurement model showed that an overall model including both abilities and dimensions of wellbeing as underlying factors gave a good fit. Thus, measuring SMA as an overall concept of abilities systematically linked to dimensions of wellbeing is possible, whilst at the same time, a profile composed of interrelated abilities can be seen. Measuring change in

separate self-management abilities should preferably be done multivariately. Comparing individuals should be done using a profile of self-management abilities simultaneously, because their variances are correlated and they share a common conceptual meaning, namely, forming a dimension of overall SMA.

The results obtained using the subsample lend support to the test-retest reliability of the SMAS-30. Like in Study 1, significant correlations with theoretically related constructs provide evidence for the validity of the scale. The relations between SMA and mastery found in this study also confirm the validity of the SMAS-30. Though they are partly overlapping concepts, SMA was found to differ from mastery and to have its own unique predictive value. The overlap between SMA and mastery was smaller than that between SMA and self-efficacy.

2.4 Overall discussion

The results of the reported studies show that the SMAS-30 is a promising self-report questionnaire for measuring SMA in elderly people. The analyses showed one well-fitting valid model that measured the 6 abilities and 5 dimensions of well-being as we used them to construct the scale. SMA can thus be measured as an overall concept of abilities systematically linked to dimensions of well-being, showing a profile composed of interrelated abilities at the same time. Regarding the subscales, we have shown that they all contribute to the overall construct. The subscales are internally consistent and one-dimensional. Future research could focus on validating the separate subscales.

All findings of the design study (Study 1) regarding structure and validity were confirmed when the scale was tested (in Study 2) in a large community sample. This indicates that the findings are robust. In addition, the SMAS-30 shows good stability over a period of 16 weeks. Significant relations with partly overlapping constructs (general self-efficacy and mastery) provide evidence of the validity of the SMAS-30. Moreover, the SMAS-30 has its own unique predictive value for the positive dimension of well-being after these partly overlapping constructs have been controlled for. The SMAS-30 is also significantly related to age, frailty, health perceptions, and several different measures of well-being.

Though the SMAS-30 appears to be a promising instrument, some points can be improved. An aspect of the scale that may need to be considered is the character of the Positive Frame of Mind subscale. The Positive Frame of Mind subscale can be distinguished more strongly than the other subscales, showing that this self-management ability may be slightly different from the others (more cognitive and not specifically tied to the dimensions of well-being). A second point deserving further research is the low 'social desirability' of items referring to status. Those items may, especially in interview situations, result in many missing answers when respondents refuse to answer those questions (in our first study, the percentage of missing answers

to the status items in the interviews was about 18). As a third point, it may be necessary to investigate the validity of the separate subscales. Lastly, future research into the SMAS-30 should further investigate its validity and usefulness in practice. In two intervention studies with elderly participants that were carried out in our research group, the SMAS-30 has shown to be sensitive and well fit to measure change in SMA due to the interventions [39; Chapter 7 of this dissertation]. Despite the mentioned limitations, the present study shows that the SMAS-30 may provide an important contribution to the measurement of self-regulation of well-being and to the testing of self-management interventions. Whereas most research into self-management has used general measures of control, like self-efficacy or mastery, the SMAS-30 was found to measure a unique feature involved in the self-regulation of well-being with age.

2.5 References

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